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MARY CYNTHIA DICKERSON, *Editor*

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DONALD B. MACMILLAN

Leader of the Crocker Land Expedition, which went North in 1913 and returned in the summer of 1917. The main aim of this expedition was to find and explore land which Peary thought he saw northwest of Grant Land and which he had named Crocker Land. This appearance of land undoubtedly was a mirage, for a sledge journey was made by Mr. MacMillan over moving sea ice to a point beyond where the land was thought to lie, without discovering any conditions indicating nearness of land. Other sledge journeys of geographical interest were made, notably to Finlay Land and North Cornwall and along the western coast of Ellesmere Land from Cape Sabine to Clarence Head.

According to agreement among the three organizations supporting the expedition, the American Geographical Society, the University of Illinois, and the American Museum of Natural History, publication of all geographical reports lies with the American Geographical Society. It is with pleasure that the JOURNAL presents the accompanying article on "Food Supply," together with some of Mr. MacMillan's remarkable Arctic photographs.

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Food Supply of the Smith Sound Eskimos¹

A STORY OF PRIMITIVE LIFE MAINTAINED ON THE NATURAL
RESOURCES OF A FROZEN ARCTIC LAND AND SEA

By DONALD B. MACMILLAN

Illustrations from photographs by the Author

ALMOST beneath the very shadow of the North Pole live the Smith Sound Eskimos, the most northern people in the world, far away from the great struggle of nations. Today while we are engaged in a World War and are trying to solve problems of food and fuel shortage, they, in their warm rock huts beneath turf, grass, skins, and snow, are singing the long dark night away, and talking of the white man in the south who has gone "*pi-block-to*" (run amuck). The naked child on the bed platform is sucking a frozen egg; the mother is ripping the skin from the body of a frozen dovekie; the father holds in one hand a piece of raw bear meat, in the other, pure fat—bread and butter to an Eskimo.

Conservation of food supplies is the predominant topic of the day, not alone in our country but throughout the world, so far-reaching is the great war in its effects. The Eskimo at the top of the world does not dream as yet that a prolonged world struggle might affect his welfare seriously. How could it? He clothes himself in skins, and eats a purely meat diet—this he has done for centuries without the help of white man.

Let us review the year's work of the Eskimo people: follow the hunter out over the drifting pack ice, up over gla-

ciers, and on into the caribou and musk ox fields; let us sit with the mother and children upon the bed platform,—become one of them.

The minute subdivisions of time reveal the energy, the fervor, the ambition, the progress, and the productiveness of civilization. There are no split seconds from Cape York to Etah, no minutes, or hours, or days of the week. Time rolls majestically on without register, no trains to catch, no whistle to blow, no curfews to ring. The Eskimo takes his time. "Why hurry through life when life is too short as it is?" an old man queried of me, as I impatiently kicked my toes against my sledge.

There is, however, a certain definite time to which all Eskimos look forward with unguarded expressions of pleasure. It is the subject of conversation for weeks in advance. The long dark night has given way to continual sunshine; the snow is melting on southern slopes; water is dripping from bergs; pools of water are found in the hollows of rocks; finally the time comes when the blue of the sky is scanned eagerly day after day, and then resounds through every village the glad cry, "The little auks are here!"

The arrival of this bird marks the transition from winter to summer. From now on it is one long feast.

¹ Article and illustrations copyrighted, 1918, by Donald B. MacMillan

Hunger, suffering, and privations of the past winter are forgotten, as flying fingers work the sealskin thongs into nets and old harpoon handles into poles. "*Ark-pood-e-ark-suit! Ark-pood-e-ark-suit!*" (Little auks! Little auks!) is heard from tupik to tupik. Pets, pups, and cripples among the dogs (the good dogs are away with their masters) strain at their traces in an endeavor to haul a sledge load of shouting women and laughing children to the bird cliffs a mile away. Here are the birds in countless numbers. The talus slope is literally covered, and the air is filled, the birds resembling at a distance nothing so much as a gigantic swarm of mosquitoes.

The women take their positions in holes among the rocks which have been used for centuries. As flock after flock wheels past within reach, the long dip

net sweeps across the path, catching from one to ten birds at a sweep. Many of these birds are eaten raw upon the spot, some are cached under the rocks for the following winter, others are placed in sealskin bags and taken to the tents to be boiled, each person eating about eight birds. The skins are sucked thoroughly to remove the fat, then dried, and used in the manufacture of birdskin shirts.

The eggs of this bird and those of the eider duck are delicacies with these northern people. I have often been one in a party that gathered six thousand eggs in a few hours. Strange to say, these eggs remain fresh for a year if left under the rocks out of the direct rays of the sun. Chilled during the summer, they are frozen hard in September and during the following months. The Eskimos eat many of



This is Borup Lodge, headquarters of the Crocker Land Expedition at Etah, North Greenland, as seen in early spring from the hill above. The house is one of the warmest buildings ever constructed in the North, the walls being double with a four-inch air space. It contains a large living room, four sleeping rooms, a work room, an electrical room, and a photographic dark room

these eggs raw, sometimes boil them, and also break them into the intestinal sheath of a seal, thus making egg sausages for the winter months. The children suck the frozen egg as a child at home sucks candy.

The staple food of the Eskimo, however, is the seal, which begins to sun itself on the surface of the ice about the first of May. The hunter hides his approach by means of a white cloth bound to a small sledge, through a hole of which a rifle is pointed—a camouflage. Pushing the screen in front of him, the Eskimo creeps stealthily to within thirty yards of the seal, takes careful aim, and usually wounds the seal—although a large number succeed in wriggling into their holes to die beneath the ice.

Mr. Hoover would be delighted in seeing how an Eskimo utilizes the dif-

ferent parts of a seal; very little is wasted. The skin is used chiefly for clothing and for tents; the fat for fuel; and all the remainder of the body for food, even the intestines and eyes.

Early in the spring, along the edge of the ice many narwhals, the fabled unicorns, are seen. Extremely wary, they are approached and caught only by the most skillful in the tribe. This twenty-foot animal is highly prized by the women, for from its back is obtained the very best sinew for thread. The smooth mottled skin, especially when frozen, is considered a delicacy, and tastes very much like chestnuts. A square foot is none too much for a moderate eater. The meat itself is dark, bloody, and oily; frozen hard and consequently very tender, it is delicious at the close of a long cold drive—almost anything is.



The Arctic home of the Crocker Land Expedition, as it appeared during the short Arctic summer. Well heated during the long winter, lighted by electricity, and having telephone communication with the surrounding Eskimos in their igloos beneath the snow, this house provided quarters more comfortable and convenient than many a New York apartment during the late cold snap

For Eskimo dogs, walrus is *par excellence* the food. A walrus weighs from one to three thousand pounds, and its capture is of vast importance and a source of congratulation. Seldom unaided does an Eskimo accomplish this feat, because of the fighting qualities of the animal and its tremendous bulk. Help is always at hand and eagerly proffered; for to all who help comes a portion of the precious meat. Small boys are seen with large knives busily engaged in amputating a huge hind flipper, skillfully severing muscle attachments and avoiding all bone. The body seems to fall apart of its own weight into twenty-two pieces, which apportioned, or better, seized by all engaged, are cached under a pile of rocks to be sledged to the winter home by dog team some months later, where they arrive as hard as boulders.

For a few days while thawing, the meat serves as a buffet lunch for family and visitors, who are continually hacking it with hatchets and knives. Frozen

meat is much more tender than cooked, is easily digested, and highly nutritious. Strange to say, the Eskimo affirms that it has greater heating properties than when cooked. Raw, frozen walrus liver served with bits of fat, we should say at home, but at Etah, "a bite of liver and a bite of fat," is the entrée which often assumes the proportions of a full meal. Walrus meat is tough, too tough for the weak jaw muscles of a white man.

Fish do not seem to be caught or eaten much by the Eskimos of Smith Sound. The number of salmon caught is negligible, a few being obtained at the head of Inglefield Gulf, at Etah, and from the lakes near Rensselaer Harbor. The meat is very poor in quality, seeming to lack flavor-producing fat.

In the fall, Arctic hare are numerous, and in excellent condition after a two months' diet of grass, willow, and the tender leaves of various kinds of low plants. The meat is excellent and relished by all. Oftentimes, I believe,



The little auks were in countless numbers on the talus slope; the ground, too, was literally covered with them, and often the air was so filled that at a distance they resembled a swarm of mosquitoes



It is a great day for the Eskimos of Etah when the little auks arrive, and immediately the women and children start for the little auk cliffs at the head of Foulke Fiord. Laughing and shouting they set forth, for they are certain to capture from one to ten of the birds at each sweep of their long dip nets, and the food shortage of this most anxious part of the year is past



The Eskimos gather the eggs of both eider duck and little auk by the boat load. I have seen six thousand gathered in a few hours. These eggs will remain fresh for at least a year if placed under the rocks, away from the direct rays of the summer sun. Eggs are sometimes boiled but more often are eaten raw and frozen. A frozen egg as a winter delicacy brings as much enjoyment to an Eskimo child as does candy to the child in the United States



LITTLE AUKS ABOVE THE NESTING SITE AT ETAH, NORTH GREENLAND

It is indeed a time of rejoicing in the Eskimo village when the cry is heard, "The little auks are here!" For this marks the coming of summer, when the long dark night gives way to continual sunshine, the snow melts on the southern slopes, and the water drips from the bergs and forms pools in the hollows of the rocks



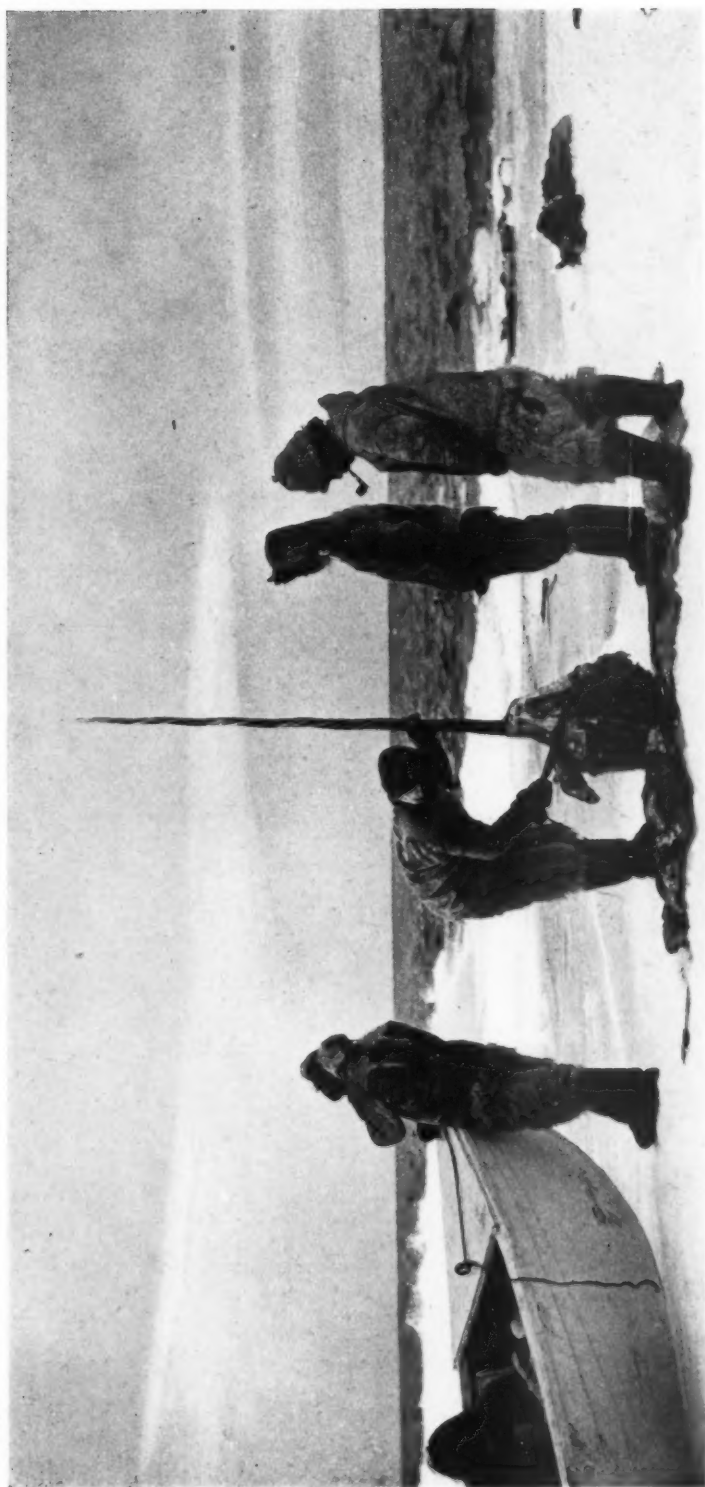
THE "TIGER OF THE NORTH," HOLDING DOGS AT BAY

Polar bear hunting might well be called the national sport of the Eskimos, who have many stories to relate regarding the "big bear." What a picture he makes in his coat of yellow fur above the white snow, surrounded by dogs, none daring to go within reach of his powerful claws and glistening teeth



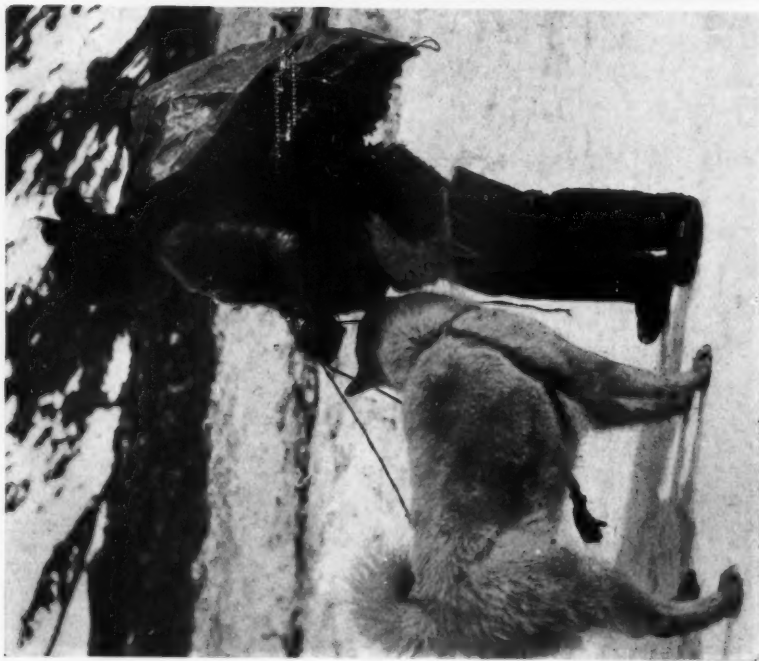
A GIANT NARWHAL—GOOD FOOD FOR MANY WINTER DAYS

Hauling a narwhal out on the ice by the employment of a very ingenious rawhide tackle devised and used by the Eskimos for centuries. — The twenty-foot narwhal is an extremely wary animal and can be caught only by the most skillful of the tribe. The smooth, mottled skin is considered a great delicacy, especially when frozen, and a square foot is none too much for a moderate eater. It tastes much like chestnuts. Dried narwhal meat also is highly prized by the Eskimos, while from the back of the animal is obtained the very best sinew for thread



THE NARWHAL'S TWISTED IVORY "HORN"

The eight-foot horn is an enlarged canine tooth of the male narwhal. Very rarely two "horns" of equal length are found. Previous to the introduction of wood among these Eskimos the ivory horn of the narwhal was used for harpoon shafts, killing irons, and sledge shoes



The Eskimo women wear sealskin bags supported about the neck, in which to bring home their quarry of little auks. Many of the birds are eaten raw upon the spot; some of the remainder are cached under the rocks for winter use, but a large number are carried home in the sealskin bags to be boiled for feasts in the tents



Ah-nee-na is bringing home two salmon trout caught in Alida Lake at the head of Foulke Fiord. Salmon are not caught, however, if other food can be obtained



In the fall, Arctic hare are not only numerous but also in excellent condition, after a two months' diet of grass, willow, and the tender leaves of herbaceous plants, and a backload such as Ah-nah-we is bringing home is of high food value

THE LAND, THE AIR, AND THE WATERS OF THE ARCTIC YIELD FOOD



A FALLEN MONARCH OF THE GREAT LONELY WASTES OF ELLESMERE LAND

The Eskimos make annual journeys to the musk oxen grounds of Ellesmere Land. Hundreds of musk oxen are taken out each year, providing the very best meat and skins. The animal is easily approached, with the help of dogs, and falls a victim to the killing iron as quickly as to the modern rifle. The bulls always advance in defense of the herd and are the first to fall



The little ringed seal forms the staple diet of the Eskimo. All food administrators of the World War would delight in the Eskimo's conservation of this food supply. No smallest part is wasted, even the intestines and the eyes are utilized as food. The skin furnishes tent material and clothing, and the fat is stored for winter fuel

in the past this animal has kept the Eskimo family from starvation in the decreasing twilight of better times—the long summer day. The locker is

empty. During the winter months many visitors have called. Walrus and seal meat, birds and eggs are gone. There is but little blubber. In semi-



Seals begin to appear on the ice above their breathing holes about the first of May. The Eskimo seal hunter makes use of what we have learned to call a camouflage. He approaches his quarry screened by a white cloth which he binds on the front of a small sledge. Creeping stealthily across the ice to within thirty yards of the seal, he aims his rifle carefully through a hole in the screen and usually succeeds in wounding the animal



From the skin of the bearded seal the Eskimos manufacture their harpoon lines and boot soles

darkness the Eskimo family sits fully dressed upon the bed platform listening to the roar and whizz of wind and drifting snow past the translucent window of seal intestines. Where is the meat to come from? The sea ice extends offshore about twenty miles. Far away at its edge there may be walrus, but if sea and wind should break the pack, death would be the inevitable result. No seals are up on the surface of

the ice as yet, and the breathing holes are hard to find. On the land in the neighborhood of the Eskimo village there are but two living things, the Arctic hare and the Arctic fox. Before the advent of the white man, the fox was caught in rock traps, the hare was snared and shot with the bone bow and stone-tipped arrow. At present cheap, small caliber Remingtons and Winchester are used.



Arklío, dog driver of the expedition, and dead caribou at the northern end of Axel Heiberg Land. The Eskimo values the caribou for its tender meat, but more for its light warm fur



With an equipment consisting of harpoon and float Eskimos hunt the walrus from their kayaks. The capture of a walrus is cause for great congratulation to the successful hunter

In the coast region between Cape York and the Humboldt Glacier, musk oxen became extinct in 1860, not due to the introduction of firearms, but to the human instinct to kill something. This animal, with the help of dogs, is easily and fearlessly approached, and falls a victim to the killing iron as readily as to the modern rifle.

Since 1898, when Peary first win-



Etook-a-shoo is inflating a sealskin to be used as a float in hunting walrus. This will be attached to the end of the harpoon line, and its position on the water after the harpoon has been thrown will mark the spot where the body of the walrus has sunk

tered in Smith Sound and obtained musk oxen at Bache Peninsula, Ellesmere Land, the Eskimos have journeyed almost annually to these musk oxen grounds. In 1907 they first crossed the heights and descended into Bay Fiord and Eureka Sound, from which region hundreds of musk oxen were taken out last year, furnishing the very best meat and skins.

Another important food of the Eskimo is the caribou which is valued more for its light, warm skin than for its flesh. Caribou meat is tender and sweet, but lacks stamina-giving properties for dog or man. Each year, in October, six or seven sledges can be seen slowly ascending Brother John's Glacier at the head of Foulke Fiord. The trail leads to the north, to the rocky valleys and glistening lakes lying between the coast and the ice cap of Greenland. The children laugh, and chatter, and talk of hearts, tongues, and liver; the women watch their fox traps dangling from the back of the sledge and visualize themselves riding into southern settlements during the

long moonlit periods in their new blue fox coats. The men talk of long difficult shots, of raw tenderloin, and frozen brains.

Polar bear hunting might well be called the national sport of the Eskimo. Father and mother and child are filled with stories and traditions of "*Nanook-suah!*" (big bear). King of the White North, he has only two enemies, the Eskimo and his dog. See the picture! A yellowish white body mounted on a snow-white pedestal, surrounded, as I often saw him, by ninety dogs! And not a dog with courage to go within reach of those powerful claws and glistening white teeth.

Bear flesh cooked is oily and tough; frozen and raw, it is delicious. What is obtained is put in cache, and carefully preserved for the forthcoming visits of relatives and friends. It is the best which the host can offer, a badge of honor and a mark of prowess. The

successful polar bear hunter is highly respected by all in the tribe.

There is one other dish which the Eskimo is very proud to offer to his friends, one perhaps the most highly prized of all. Following my arrival at a winter home several miles below Cape York, the host immediately harnessed his dogs and dashed off in the darkness, returning an hour later with what resembled the body of a seal. Upon closer examination, it proved to be the stuffed skin of a large ringed seal. Imagine my surprise upon seeing the Eskimo cut a slit in the side, roll up his sleeve, and plunge in his arm to the elbow. As he withdrew it, clutching in his hand several objects of questionable food value, I decided that in the dark he had brought in the wrong bag, or was going to feed the dogs. But if you could only have tasted those black strips of meat! My introduction to dried caribou tongue some years before



The walrus weighs from one to three thousand pounds, and its capture is not often effected by an Eskimo unaided, because of its fighting qualities as well as on account of its huge bulk. The flesh is prized by the family and is also the best food for the dogs

among the Naskapi Indians had been very pleasant. My second introduction to dried meat—the contents of the bag had proved to be dried narwhal—served with oil was even more agreeable. The definition of what constitutes good food varies according to a man's appetite, the magnitude of which depends upon his physical condition. Extremely low temperature in the north demands heat-producing food. The internal fires must be kept at full blast. However, no Eskimo of my acquaintance ever "greedily consumed the contents of an oil lamp," as narrated by travelers, or "devoured blubber in huge chunks." He is not a blubber eater, as characterized. We relish fat on our bread; the Eskimos relish fat with their meat.

When the body is compelled to draw all its nourishment from meat alone, naturally very large quantities are consumed, in the endeavor to seize upon all the various ingredients needed for energy and for the renewing of wasted tissue. An Eskimo family of four easily consumes four thousand pounds of meat in a year, about half of which is eaten raw and frozen. A kill is always followed by gorging, and a long sleep. "Eat all that you can possibly hold" is the law of the Eskimo, who believes in enjoying his food while he has it, for days are coming when caches are empty and the larder lean.

It is interesting to note that among these apparently perfectly healthy people there are lacking what we as civilized people consider essential for the maintenance of good health, namely, bread, fresh vegetables, fresh fruits, salt, and sweets. The medical profession for years considered fresh vegetables or lime juice necessary for the prevention of scurvy, so prevalent among the crews of whaling ships and Arctic expeditions. The Eskimo of Smith Sound knows no scurvy.

Is it true that the World War is so far-reaching that no nation or savage tribe will not feel its effects? At first

thought the Smith Sound tribe of Eskimos, three thousand miles to the north, seems as remote and as independent of civilization as any tribe in the world. Yet within a year after war was declared, the warning note reached the Eskimos, "Save your cartridges; the white men in the south are fighting and need them all."

Had the white man never gone into the north, the savage would still be free and independent of white man's goods; but after becoming used to them, if deprived of them today, he would fare ill, I am afraid, for years to come. From 1891 to 1909 Rear Admiral Peary kept the Smith Sound Eskimos well supplied with what they now consider essentials, namely, firearms, ammunition, wood for kayaks, sledges, and harpoon shafts, steel traps, knives, matches, needles, thimbles, and tobacco. During the last eight years there has been a Danish trading station at North Star Bay, which has supplied the Eskimos with these and various other commodities—at present utterly lacking because of the scarcity and high price of supplies and the nonarrival of the trading ship in 1917.

After these years of dependence on white man's goods, it would demand of the present generation of Smith Sound Eskimos most severe discipline, extreme suffering, and probably death, to be obliged to return to the hunting methods of a century ago, to the bone bow and stone-tipped arrow, to the unwieldy ivory harpoon shafts, to flint and meteoric iron knives, and to the patient stalking of caribou and seal by the imitation method. This tribe, to which the American people owe so much, cut off from the world to the south, poorly clothed and ill-fed, would dwindle in numbers to a pitiful few. When another summer's sun temporarily frees the waters of ice, they will be standing on the cliffs watching for the smoke of the on-coming steamer to tell them that the world is at peace.

SCENES FROM THE EASTERN ARCTIC¹
REPRODUCTIONS IN GRAVURE FROM PHOTOGRAPHS
BY DONALD B. MACMILLAN

LEADER OF THE CROCKER LAND EXPEDITION, 1913-1917

In addition to its scientific data and collections in geology, botany, zoölogy, and other lines of field research, the Crocker Land Expedition brought back nearly 5000 negatives and 12000 feet of motion picture film. These are of especial value in showing the country and the manners and customs of the Smith Sound Eskimos.



PAN ICE AT ETAH, NORTH GREENLAND

Salt water freezes in the North to a thickness of from six to nine feet. This shows one season's ice which drifted from the inner bays and fiords out into the harbor of Etah about July 1. There are about ten Eskimos living at Etah.

There are 276 Eskimos altogether in the Smith Sound tribe. Contrary to the prophecy of early explorers, this tribe is increasing in numbers. In 1906 there were only 211. Etah is the most northern settlement; the most southern is Cape Seddon in Melville Bay.

¹ Illustrations and text, together with the preceding article, copyrighted, 1918, by Donald B. MacMillan



MACMILLAN'S DOG TEAM AT ETAH, NORTH GREENLAND, IN SUMMER

These dogs traveled 8000 miles in the four years of the expedition's work. Upon one occasion they traveled five days with no food whatever, covering 180 miles. Walrus meat is the best dog food in the eastern Arctic. When the expedition lacked fresh meat for its dogs, pemmican was used, made of the best dried beef and suet.

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CROCKER LAND EXPEDITION CAMP ON SEA ICE

In the construction of a snow house about forty-two blocks, 24 x 18 x 4 inches in size, are used. When traveling over sea ice, we made a new house each night, consuming in time about fifty minutes



BUILDING A SNOW HOUSE AT PETERAVIK, NORTHWEST GREENLAND

Note the small houses at right and left of the large igloo. These were constructed for storage of the expedition's meat and other supplies so that they would be safe from attacks by the dogs or by wandering bears or foxes



PULLING OUT A NARWHAL, THE FABLED UNICORN OF THE ANCIENTS

These animals are from fifteen to twenty feet in length. The long, spirally twisted tusk which protrudes from the left upper jaw like a horn turns into ivory of commercial value

**ETAH FIORD AND
BORUP LODGE
IN EARLY SEPTEMBER**

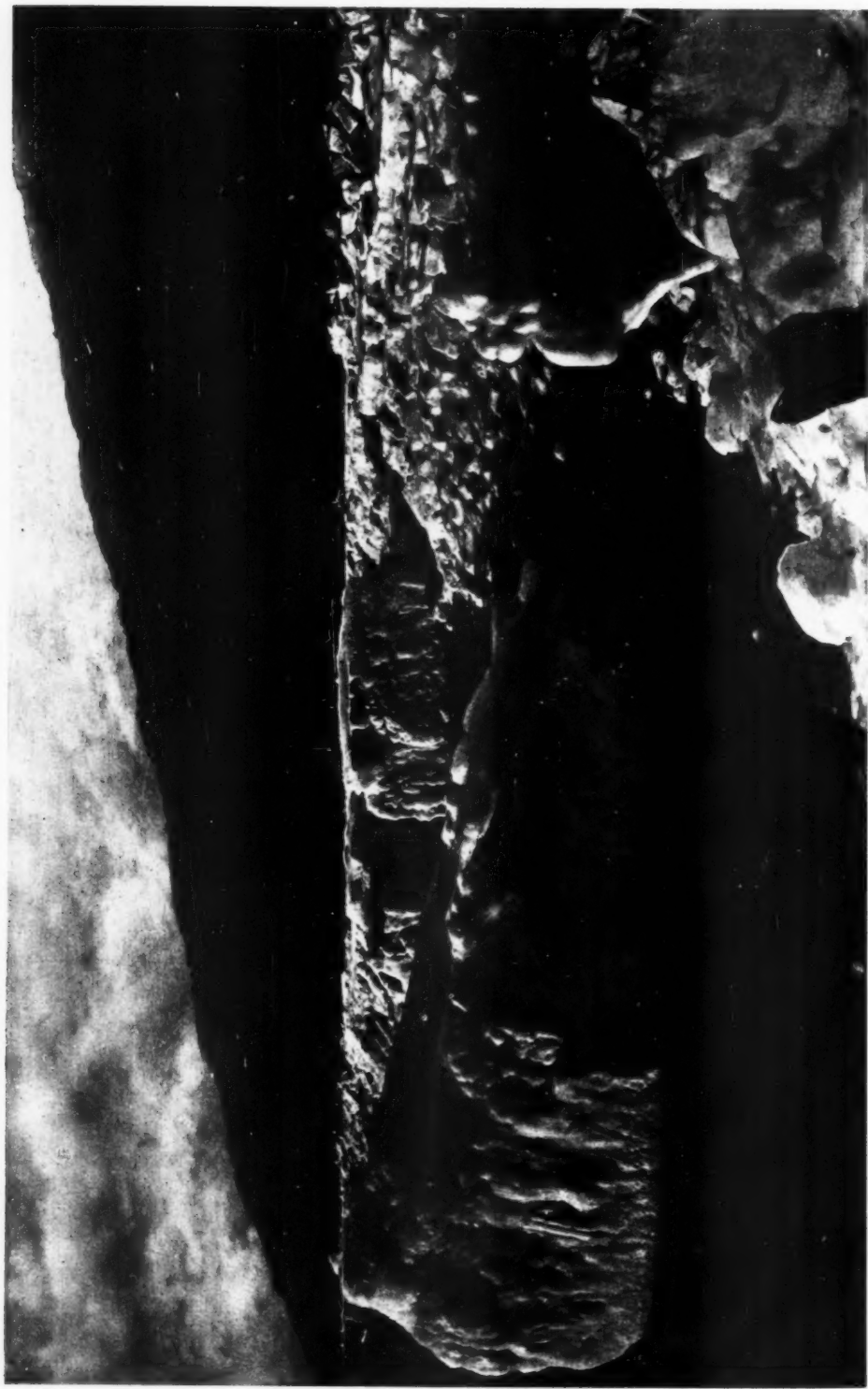
The first fall of snow on the hills and the first ice in the harbor, as seen from the hill west of the headquarters of the expedition. Etah is a little village where some of the Smith Sound Eskimos live, in their stone huts from September to May and in sealakin tents during the summer



A BED OF FLOWERS AT ETAH

After the early purple saxi-
frage, which appears about
June 10, comes the yellow
Arctic poppy. This begins to
bloom about June 20 and re-
mains until August 25. It is the
flower which is found at the
most northern point of known
land in the world, Cape Morris
K. Jesup, only three hundred
and seventy miles south of the
Pole





LOW WATER AT ETAH IN SEPTEMBER, SHOWING FORMATION OF ICE FOOT

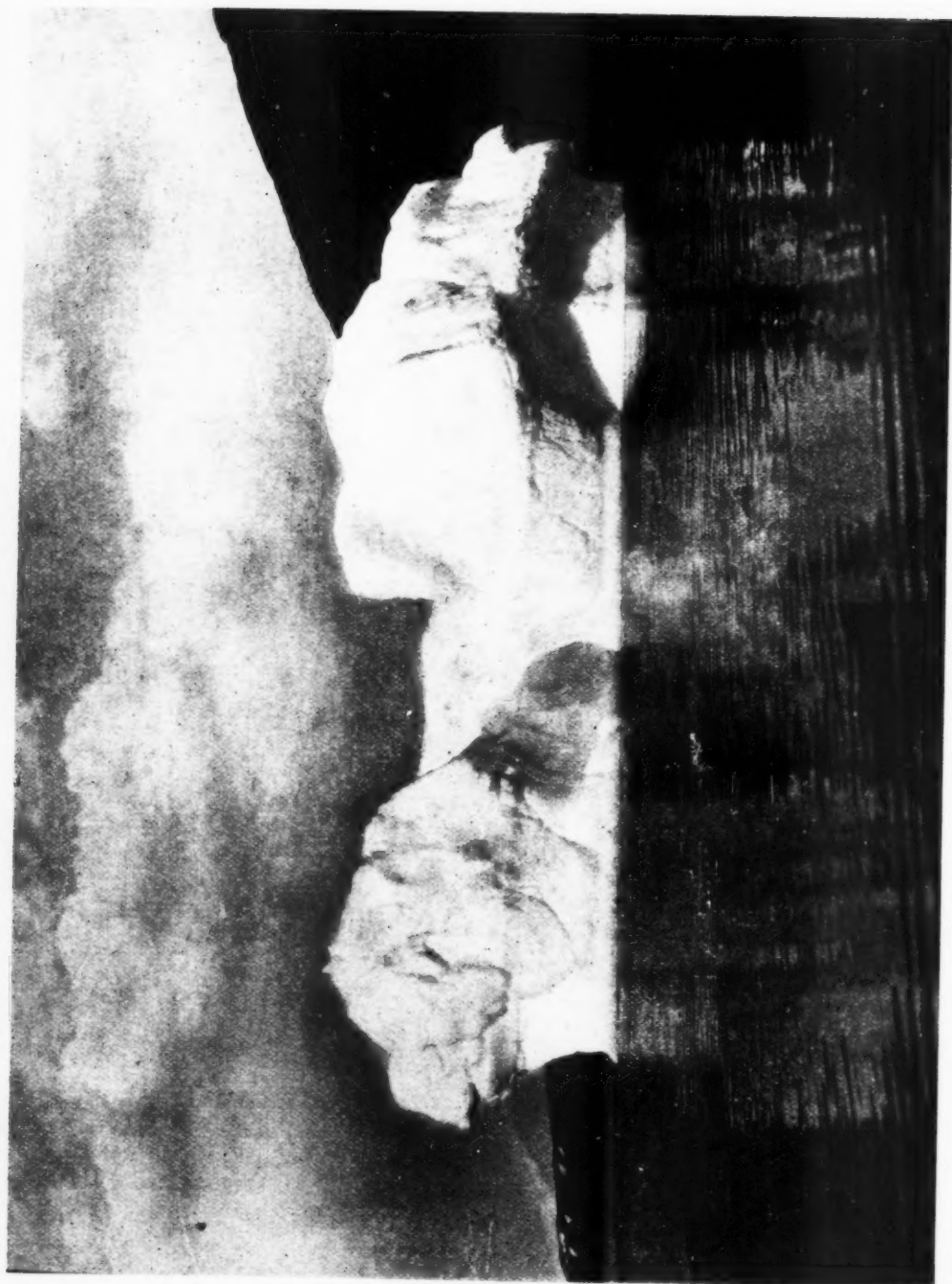


FASHIONS IN FUR

Al-ning-wah, wife of Arklio, the expedition dog driver, can well smile and defy the fifty degrees below zero, for she is wearing a blue foxskin coat, the fashionable winter costume among the Smith Sound Eskimos. Shy little Megishoo, the boy, Kah-da and Al-nee-na, the best seamstress for the Crocker Land Expedition, are wearing coats made from skins of the little ringed seal. Note the pattern of Al-nee-na's hood, cut high to accommodate her hair underneath.

AN ICEBERG AT ETAH

An offshoot from the front of some glacier, it has come from the heights of Greenland, moving gradually toward the sea at the rate of from a few inches to ninety feet a day





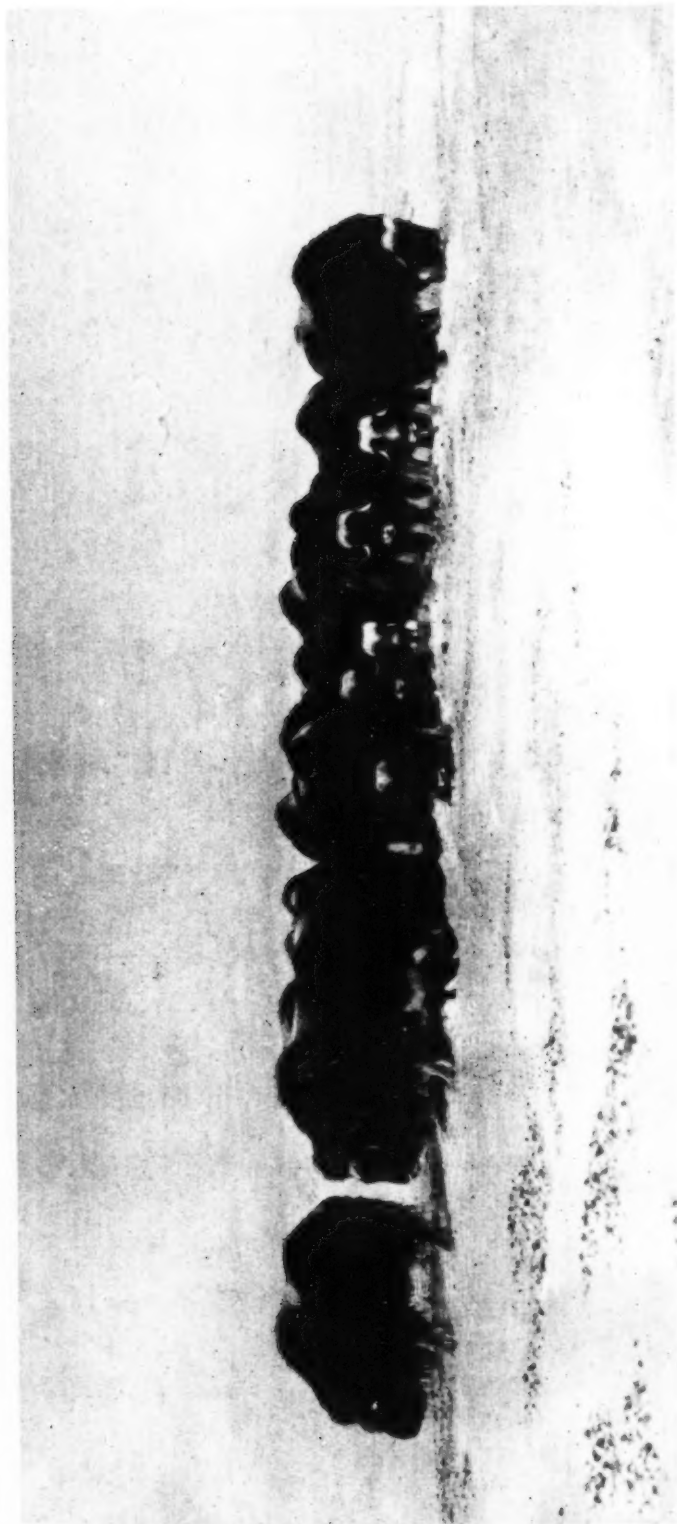
THE KING OF THE NORTH

In the harbor in front of the Crocker Land Expedition's headquarters at Etah. The polar bear has but two enemies, the Eskimo and his dog. Bear meat is the best offering which an Eskimo host can offer, its possession being a badge of honor and a mark of prowess.

THE WITCHERY OF THE NORTHLAND

The Sonntag Glacier at
Sulwuddy, south of Cape Alex-
ander. The Sun is due south.
Scenes like this stay in the
memory and bring homesick-
ness for the silence and great
spaces of the Arctic





Photograph by W. Elmer Eklow

HERD OF MUSK OXEN ON THE FOSHEIM PENINSULA

As late as 1881 it was thought that these animals must migrate southward during the winter for food. They have been found, however, at the most northern points of Grant Land and Greenland during the darkness of the winter night, feeding on the frozen grass laid bare by violent winds



THE FROZEN NORTH

The region about Clements Markham Glacier, south of Peteravik, Northwest Greenland, is the great spring hunting ground of the Smith Sound Eskimos. Since 1898, when Peary first wintered in Smith Sound and obtained musk oxen at Rache Peninsula, Ellesmere Land, the Eskimos have made almost annual visits to this place.

The region about Clements Markham Glacier, south of Peteravik, Northwest Greenland, is the great spring hunting ground of the Smith Sound Eskimos. Since 1898, when Peary first wintered in Smith Sound and obtained musk oxen at Bache Peninsula, Ellesmere Land, the Eskimos have made almost annual visits to this place.



SHOO-E-GING-WA WITH POPPIES



Weird effect of the midnight sun behind an iceberg



The midnight sun photographed at twenty-minute intervals from Sunrise Point looking due south over Littleton Island—well known for its marked place in Arctic history. The dip of the sun in the North depends upon the latitude of the observer. At the North Pole such a line of suns would be nearly straight, that is parallel with the horizon, gently rising until June 21, after that date falling until September 20, when the sun would set below the horizon for the long night of six months

"The Origin and Evolution of Life"¹

A NOTABLE BOOK BY HENRY FAIRFIELD OSBORN

By FRANK R. LILLIE

Professor of Zoölogy at the University of Chicago

THIS attempt to define the problems of organic evolution in terms of modern mechanistic science represents the first comprehensive effort in this direction. For many years the tendency of research has been toward specialization at a constantly accelerating rate, with a consequent accumulation of scientific treasure in physics and chemistry, in astronomy, in geology, and in the various biological sciences. In the last, progress has been marked by a more rigorous exactness of biological conceptions, by the extension of biological chemistry and the origin of new ideas concerning chemical correlations within the organism, by an immense development of the cell doctrine which dominates the special physiology of every part, by the rise of exact genetic study and the extension of experiment to all parts of the analytic biological field, by the rapid growth of palæontological knowledge and the consequent revision of animal and plant classification—and by much besides. Every specialist was so engrossed in the beauty and fertility of his own problems, and so impressed with the almost radically insoluble character of the fundamental questions of his own field, that the greatest of all biological questions, the synthesis of the whole—the origin and evolution of life—seemed even farther removed and more difficult than it could have appeared to the naturalists of Darwin's time.

To be the architect of this supreme construction, who so fitted as the palæontologist who has the sense of time the creator—who coöperates with the

geologist and thus lays hold of the genesis of the earth itself? But the palæontologist who would attempt this must link hands with the biologist who experiments and deals with life in action.

Professor Osborn has these contacts and has used them; he has had the co-operation of scientists in all fields. His book stands midway in the Hale Cosmic Evolution Series of Lectures of the National Academy of Sciences, which opened with Sir Ernest Rutherford's discourse on "The Constitution of Matter and the Evolution of the Elements," and continued with "The Evolution of the Stars and the Formation of the Earth" by William Wallace Campbell, and the "Origin of the Earth" by Thomas Chrowder Chamberlin. It thus rests on these authoritative presentations of the present status of inorganic evolution, and essays to bridge the greatest gap in the evolution problem—from lifeless to living—and to formulate the most difficult of all evolutionary problems, that of living things.

The author is fully aware of the greatness of his task. In the preface he says: "In these lectures we may take some of the initial steps toward an energy conception of Evolution and an energy conception of Heredity, and away from the matter and form conceptions which have prevailed for over a century." Again: "We are not ready for a clearly developed energy conception of the origin of life, still less of evolution and of heredity; yet we believe that our theory of the actions, reactions, and interactions of living en-

¹ *The Origin and Evolution of Life, on the Theory of Action, Reaction and Interaction of Energy*, by Henry Fairfield Osborn. Charles Scribner's Sons, New York, 1917, pp. xxxi, 322 with 136 illustrations.

ergy will prove to be a step in the right direction."

The problem leads from a purely inorganic world to a world with simple life forms, and from such a simply peopled world to one with all the amazing richness and diversity of the living present. Astronomy and geology furnish us with a clear and simple conception of the evolution of the stellar universe and of the earth itself, demonstrable in many of its features. Do these processes of evolution lead to the origin of life forms, or with the origin of life forms have we a manifestation of some new principle? If life forms originated conformably with stellar and world forms, was it a gradual or a sudden process? Has the farther evolution of organisms proceeded according to definite physiological laws of development, or has it been guided by chance as conceived by Darwin?

Whatever the difficulty of these questions, however inconceivable it may appear that demonstrable answers can be furnished, or that the almost infinitely various detailed problems on which the solution of the whole rests should be worked out, it is impossible that the attempt should not be made to work out a single causal nexus of events. A great merit of the present work is that it evades no difficulty, but clearly sets forth the problems to be solved, and utilizes all the resources of the various evolutionary sciences to furnish suggestions and propose hypotheses.

That evolution is due to the actions, reactions, and interactions of the forms of matter and energy of the primitive world, which occur everywhere in the universe, is the guiding idea. These constitute four groups in the actual evolutionary process, namely, the inorganic environment, the organism, the heredity-germ, and the life environment—hence the term tetraplasy—and selection is operating constantly at every stage of the process.

The chapters deal with the prepara-

tion of the earth for life; the sun and the physicochemical origins of life; energy evolution of bacteria, algæ, and plants; the origins of animal life and the evolution of the invertebrates; the visible and invisible evolution of the vertebrates; evolution of body form in the fishes and amphibians; form evolution of the reptiles and birds; evolution of the mammals.

The aspect of adaptation runs all through the treatment. To begin with, Professor Osborn takes over with approval Henderson's conceptions of the fitness of the life elements and of the inorganic environment; he finds fitness in the nature of the colloidal system of protoplasm "peculiarly favorable to . . . the free interchange of physicochemical energies." He emphasizes the adaptation of the organism to the environment, and the adaptation of the internal correlations of the organism through internal secretions, enzymes and the nervous system. Special aspects of adaptation are dealt with in the laws of form evolution with reference to locomotion, offense and defense, and reproduction, as illustrated in the laws of convergence and of adaptive radiation. The independently adaptive aspects of different organs, as they radiate in evolution in correlation with varied environments, "is fatal to any form of belief in an internal perfecting tendency which may drive animal evolution in any particular direction or directions. Finally, it is fatal to Darwin's original natural-selection hypothesis, which would imply that the teeth, limbs, and feet are varying fortuitously rather than evolving under certain definite although still unknown laws."

The study of evolution runs in two closely related parallel lines, the visible line of the body or soma and the invisible line of the germ or "heredity-chromatin." The author states the Lamarckian hypothesis that somatic evolution precedes and controls germ-

evolution and the revised Darwinian hypothesis that germ-evolution is primary but undirected, and body-evolution secondary. He holds

"that our search for causes must proceed along the line of determining which actions, reactions, and interactions invariably precede and which invariably follow—those of the body cells (Lamarckian view) or those of the chromatin (Darwin-Weismann view). The Lamarckian view that adaptation in the body cells *invariably* precedes similar adaptive reaction in the chromatin is not supported either by experiment or by observation; such precedence, while occasional and even frequent, is by no means invariable. The Darwinian view, namely, that chromatin evolution is a matter of chance and displays itself in a variety of directions, is contradicted by palæontological evidence both in the Invertebrata and Vertebrata, among which we observe that *continuity and law in chromatin evolution prevail over the evidence either of fortuity or of sudden leaps or mutations*, that in the genesis of many characters there is a *slow and prolonged rectigradation or direct evolution of the chromatin toward adaptive ends*. This is what is meant in our introduction by the statement that in evolution law prevails over chance."

The chapters on the evolution of the vertebrate classes are a brief and illuminating survey of a field of the greatest popular and scientific interest, which has hitherto been accessible only to the specialist. This part of the subject lies within the author's own field of research, and has special interest on that account. It is illustrated with many beautiful reconstructions and drawings of extinct forms based on the rich collections of the American Museum of Natural History and other

sources. In the work he has had the collaboration of Dr. W. K. Gregory in the reconstructions, and the skillful animal artist Charles R. Knight in the drawings.

The entire graphic and fascinating presentation of the history of life upon the earth is such as only a master in palæontology could present. The theory, therefore, naturally concerns primarily the great evolutionary movements. The writer, however, constantly emphasizes the principle, that the great evolutionary events and tendencies that may span millions of years are the resultant of the elementary laws of biology. But he does not attempt to utilize such laws in theoretical construction, but rather for illustration often of an exceedingly apt character; an example is the application of hormone theories to explain certain changes of proportion of parts in the evolution of mammals. The laws of inheritance and of experimental biology with relation to evolution are, however, to form another volume of the same series by Professor Conklin.

By virtue of its very rigor and comprehensiveness the book leaves us with a sense of almost infinite inadequacy before the problem of the physiology of form and character evolution. The morphology of the process we are beginning to know with some approach to completeness in certain places. Will it ever be possible to trace the actions, reactions, and interactions of Professor Osborn's four complexes of energy in the evolution of living things? Certainly before this can be done the physiology of embryonic development and of heredity must be much farther developed. But to have surveyed for us the field from so rich a fund of experience is a notable service to that integration of scientific work which is so great a need of the present.

HEREDITY-CHROMATIN— A CENTER OF PHYSICOCHEMICAL ACTION

Osborn's book, *The Origin and Evolution of Life*, discusses four great interrelated evolutions guided and controlled by four great sets of interacting energies. One is the evolution of the earth itself, which becomes the environment or home of any organism, to which it must adapt itself or die; another is the great world of plants and animals among which any organism lives, its *life environment*, where also it must adapt itself or die and end its race—in other words where "selection" acts to preserve or eliminate it. The other two are respectively the visible and the invisible (the latter purely speculative) evolutions that take place in the organism itself, that is (1) the evolution of the body which is temporary and will die and (2) the evolution of the heredity-chromatin of the germ, that connection between organism and organism of successive generations, which does not die and represents the continuity of life from the beginning until to-day.

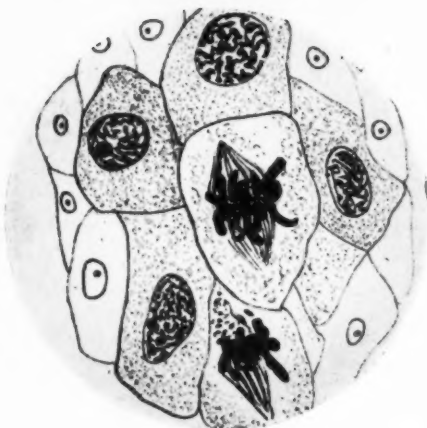
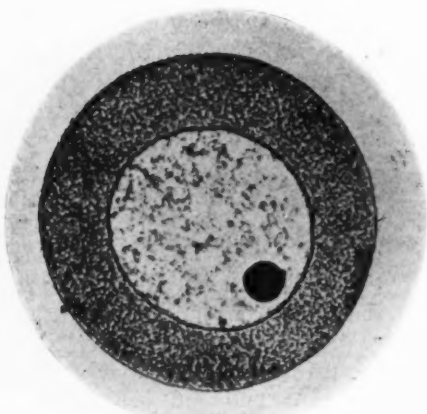
The heredity-chromatin (shown black in the figures), always in a surrounding protoplasm (shown grayish dotted), is visible under a microscope, and certain items of its behavior can be observed. Chemically it contains an unusually large amount of phosphorus, and is one of the most complex of all substances. Scientists believe that it carries the heredity determiners, both of the individual and of the species. Under its influence the cell protoplasm divides and subdivides into self-reproducing cells.

The upper figure shows an egg cell from the ovary of a sea urchin. In this resting stage the chromatin is concentrated into a small sphere.

In the middle figure are cells from the rapidly growing root tip of an onion.

Below are cells from the embryo of a giant redwood tree.

In the large cell in the center the chromatin is seen dividing into rod or sausage-shaped masses. These are grouped in two rows facing each other at the middle of a spindle (the two rows are somewhat indistinctly shown;



note later stage in a central cell of figure next above). Later the cell divides through the middle of the spindle so that one row of the chromatin rods is drawn into one half of the cell and the other row into the other half. The heredity determiners derived from both parents are at first united and then in this way redistributed so that every cell (with certain exceptions) in the developing body of the new organism has an equal amount of chromatin carrying heredity determiners



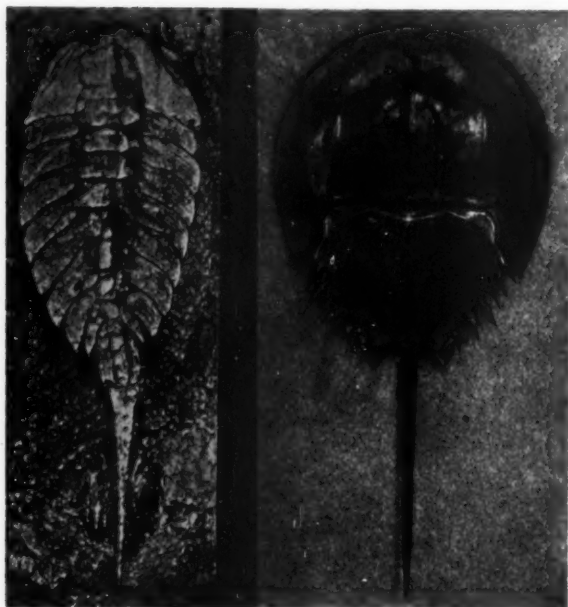
From The Origin and Evolution of Life

CHROMATIN OF REDWOOD TREE AND TRILLIUM

It is thought that each species remains constant in the bulk of its heredity-chromatin; but this bulk may bear little relation to the size of the organism. The chromatin (black rods, magnified about one thousand diameters) of the embryo of the redwood tree is somewhat less in bulk than that of the low woods flower, trillium—the former nevertheless carrying heredity determiners for an organism two hundred or more feet tall and of very long life (two thousand or more years), the latter for a relatively minute, short-lived form.

Profound interest in the study of the chromatin lies in the bare fact that it carries the heredity determiners and, distributing itself throughout the given organism, controls it to take on not only its normal species form but also its inherited individual variations and to maintain both often through many decades of radical change in the actual matter composing it.

It is remarkable that in plants, all of which, even the largest redwood tree, lack a nervous system, there is perfect and sometimes rapid coordination of parts and response to stimuli. This is probably brought about by physicochemical interactions, resulting in the circulation through the tissues of invisible "chemical messengers," corresponding with certain ferments and secretions of ductless glands in the animal body



PERSISTENCY OF TYPE

An inhabitant (*Molaria spinifera*, at the left) of the seas many million years ago (mid-Cambrian), presented for comparison with its modern descendant, the common horseshoe crab (*Limulus*).—They well illustrate adaptation to their sand and water environment, and also the persistency of a type through vastly long periods of time.

In such an example of evolution (visible of the body and invisible of the germ), the body has been in direct contact with the forces of the inorganic and the living environments; the heredity-chromatin of the germ has been remote from contact with external environments. Professor Osborn records that, nevertheless, the study of prehistoric animals tends to prove that the evolution of the heredity-chromatin, while slow and prolonged, always is directed toward adaptation of the species to its life in the given environment.

A geologic estimate made in 1899 (Geikie), of the age of life, or of the earth since bacterial life appeared, is from one hundred to four hundred million years; an estimate made in 1909 (Sollas) gives from thirty-four to eighty million years. These estimates were made by computing, at rates of deposition today, the limestone and other deposits due to the work of bacteria (followed later by other mineral-depositing life forms, algae, diatoms, protozoans, and mollusks).

Whether chromatin is as old as the bacteria, or in fact whether it exists in the bacteria of today, is a disputed question. It is the opinion of the author, following that of Wilson (Columbia University, New York) that chromatin is as old as protoplasm, and that it takes its place with protoplasm as one of the two great tangible elementary structures of all life even unto man.



OFFENSIVE AND DEFENSIVE ADAPTATIONS

The carnivorous "tyrant" dinosaur (*Tyrannosaurus*) (it towers about 18 feet from the ground) is approaching a group of horned herbivorous dinosaurs (*Ceratopsia*).

The Origin and Evolution of Life discusses the theory of the beginning of life as a recombination of energies and elements preëxisting in the cosmos. It puts forth the idea that there is an energy control of life, that energy is the cause of evolution, that some combination of energy always precedes and molds form in the living world. We recognize that invisible energy lies back of the phenomena of the electric train and of wireless telegraphy; it is possible that the energy transmitted from the microscopic chromatin, acting in an infinitely complex and, to us, mysterious way, can control the development of a giant tree or a dinosaur.

The author emphasizes that it is the function of life to "capture" energy wherever it can be found and to utilize it. Earliest forms of bacterial life, feeding directly on inorganic matter, used heat energy from the sun; green plants capture light and heat energy (they can make starch only in sunshine), storing these within themselves in passive form (in starches, oils, sugars, etc.) which the animal retransforms into active energy when the plants are used for food. The giant dinosaurs were the climax in capture, storage, and release of energy. The evolution of the defensive types proceeded step by step with that of the offensive types, producing an example of counteracting evolution similar to that in North American wolves and bison or deer. This approach by Osborn to life and evolution through a study of energies primarily and of matter and form secondarily sets a direction for future researches by the many—instead of by the few as in the past.

EXAMPLES OF CONVERGENT ADAPTATION

Animals become structurally adapted to the environment in which they live, and forms not closely related—in fact very distantly related and living in widely separated parts of the globe—may take on exactly similar adaptations when acted upon by similar environments.

This is easily seen in adaptations for aquatic locomotion. In each instance the mechanical resistance of the water to rapid motion is overcome by long and slender body lines and sidewise flattening of the tail; rapid propulsion is accomplished by sinuous movement of this long body, and sweeping paddle work of the tail, aided by movement of the fore and hind appendages which take on more or less perfectly the form of fins.

The three upper drawings represent restorations of three extinct reptiles,—ichthyosaur, primitive sea lizard, and sea crocodile; the fourth below, is an extinct amphibian; the fifth a mammal (a primitive whale)—and we know that rapid-swimming fishes also have the same adaptations.

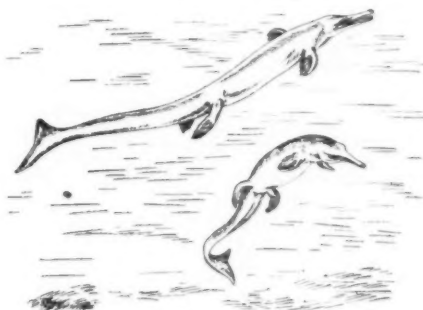
Such development of similar structures and habits responsive to similar external forces, implies similarity in the physicochemical energies of protoplasm and chromatin and orderliness in their behavior, as well as constant similarity in the working of selection



REPTILIA

CYMBOSPONDYLUS

TRIASSIC



REPTILIA

GEOSAURUS

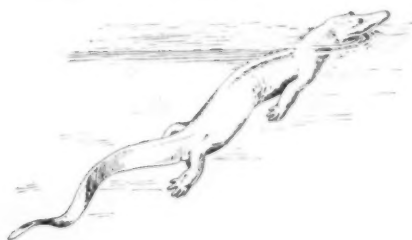
JURASSIC



REPTILIA

CLIDASTES

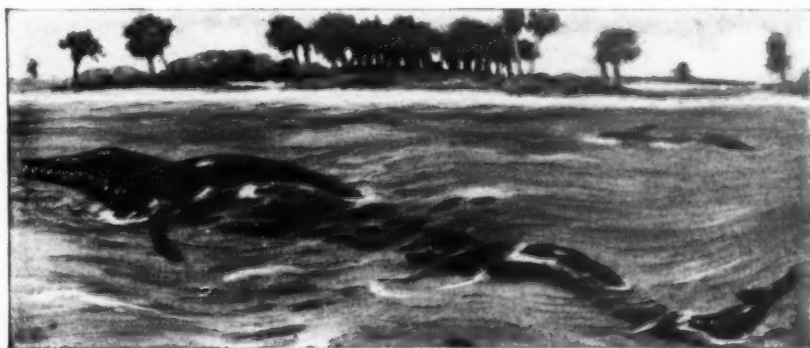
CRETACEOUS



AMPHIBIA

CRICOTUS

PERMO-CARBONIFEROUS





CHOIR OF THE LITTLE CHURCH ON THE CERRITO DEL CARMEN

Built in 1620 this chapel survived the frequent and heavy shocks of the seventeenth and eighteenth centuries only to collapse on the night of January 3, when within two years of its third centenary

The Guatemala Earthquake

By SYLVANUS GRISWOLD MORLEY

Carnegie Institution, Washington, D. C.

THREE, and each time located in a different spot, the capital of Guatemala has been destroyed by earthquakes: in 1541, in 1773, and lastly in the recent shocks of Christmas week, 1917.

Close on to four centuries ago, in 1524, Pedro de Alvarado, a captain of Hernando Cortéz, the intrepid conqueror of Mexico, penetrated this region for the first time, and brought it under the banner of the King of Spain; and in 1527 his brother, Jorge Alvarado, founded the first capital of the new Kingdom of Guatemala in the smiling valley of the Panchoy at the very base of the lofty volcano of Agua.

In spite of its sonorous title, "Santiago de los Caballeros de Guatemala" (Saint James of the Gentlemen of Guatemala), this first city of the name was destined to a short life. On the night of September 10, 1541, after some days of excessive rainfall, there was felt a prolonged and violent movement of the earth, and immediately thereafter the city was deluged by a torrent of water, mud, and rocks, which, rushing down the side of the volcano of Agua, filled the city's streets, destroyed its houses, and killed many of its inhabitants. In this calamity many people of the city, including Beatriz de la Cueva, the widow of the Adelantado and his successor in the rule of the kingdom, lost their lives. The Adelantado was drowned in the private chapel of her own home whither she had fled with twelve of her ladies-in-waiting to escape the rushing waters.

This event cast a profound gloom over the survivors, and the following year the new capital, the second city of "Santiago de los Caballeros de Guatemala," was founded in the same valley

but about one mile and a half east of the old location, that is, farther away from the base of the volcano. And all that now remains of the first capital is a crumbling ruin said to have been the house of Doña Beatriz. The site was not entirely abandoned, however, and a small village called La Ciudad Vieja, The Old City, has since grown up there.

In time the new capital became the most magnificent and populous city in Central America, having as many as sixty thousand inhabitants by the middle of the eighteenth century, and more than fifty churches, monasteries, and convents. The Franciscans, Dominicans, Capuchins, Jesuits, Recollects, and of the sisterhoods, those of Santa Theresa and Santa Clara, all had large and splendid establishments in the city, the ruins of which still excite the liveliest admiration. And all of this enterprise in the face of repeated discouragements on the part of nature, for the earthquakes continued at frequent intervals. Indeed the history of the second city of Saint James of the Gentlemen is one long series of disastrous shocks: 1565, 1575, 1576, 1577 (two), 1586, 1607, 1651, 1663, 1679, 1681, 1683, 1684, 1687, 1689, 1702, 1717, 1719, 1751, 1757, 1765, and four during the latter half of 1773.

This last blow of fate, four shocks within a six-month (two even on the same day), was too much for the long suffering citizens, and after many stormy sessions of the city council, they finally decided to move the capital a second time. In favor of this change were the civil and military authorities; opposed, were the ecclesiastics. Both the secular clergy and the monastic orders had too heavy an investment in churches and vast conventual establish-

ments to view with equanimity any change which would tend to decrease property value, and they bitterly objected to the proposed change. But in spite of this opposition the matter went slowly forward.

Royal engineers were sent over from Spain, and after due deliberation and study a new site was chosen in the next valley, twenty miles east of the former capital; and in 1776, the third city of Santiago de los Caballeros de Guatemala was formally founded here, although the government itself was not moved over until three years later. Again, as in the case of the first city, the second was not entirely abandoned. Many people refused to leave their homes, and under the name of Antigua the place has been occupied down to the present day. It is for all that, however, a city of the past; its magnificent churches and public buildings are in ruins, and its population has shrunk from sixty thousand to less than ten thousand.

The third city of Guatemala was located where it now stands because of the supposed immunity of the place from earthquakes. And when the site was chosen there were some grounds for such belief. There had stood here since 1620, on a little hill in the midst of the plain, called the Cerrito del Carmen, a small church and monastery, which had weathered successfully the numerous shocks of the seventeenth and eighteenth centuries. The site, moreover, was surrounded on three sides by steep barrancas or cañons. Rightfully or wrongfully the royal engineers believed these cañons to have been responsible for the immunity which the little church and the surrounding plain had enjoyed.

In due course of time and in spite of repeated shocks, 1827, 1830, 1852, 1853, 1855, 1858, 1861, 1862, 1870, 1873, 1874, and others of lesser intensity since, a new and still larger and more beautiful city grew up. A hand-

some cathedral was built; church and government buildings were erected. The place finally came to have a hundred thousand inhabitants and became known as "The Paris of Central America."

The present "family" of earthquakes, which culminated in the great shocks of December 25 and 29, 1917, and of January 3, 1918, began as far back as the middle of November; and indeed are probably to be correlated more remotely with the same subterranean activity as that which caused the destructive earthquake and volcanic eruption in San Salvador six months earlier, on June 7, 1917.

On the evening of November 17 last, Guatemala City experienced a brisk little shake but of short duration. During the days which followed, scarcely a week went by without some slight tremor of the earth being felt, but nothing came of it. The people became inured to these *temblorcitos* or "little shocks" as they were called, because of their very frequency, and ceased to worry about them. It seemed that even Mother Earth could cry the wolf too often. At seven o'clock in the evening of December 24 there was a second brisk little shock. Dishes rattled on the tables, electric light fixtures swung back and forth, people even ran from their houses for the moment; but again nothing came of it, except one wise order from the government that there be no performances in the moving picture theaters on the following evening.

Christmas evening about seven we felt a slight tremor but scant notice was taken of it. Perhaps by relating my own experiences in the few hours that followed I can best describe how the shocks came and how the city reacted to them. I had been out to dinner that evening and was returning to my hotel. The night was cold for the tropics, about 55° Fahrenheit, and a brilliant moon was in the sky.

Suddenly and without previous warn-



CHURCH OF THE RECOLLECCIÓN, GUATEMALA CITY

This was one of the largest churches in the city and was completely destroyed. The shock of January 3 brought down the two towers and the pediment between, shown as still standing in this picture taken after the shocks of December 25 and 29



A typical street scene. House after house in ruins and the interiors exposed to view



Temporary shelters of matting, cloth, canvas, and sheet iron.—Thousands are living in huts like the above



The Villa Earnestina on the Paseo de la Reforma, the suburban residence of the former President Reina Barrios, completely wrecked



A broken water main in front of the National Palace serves many uses. Clothes are washed on the stone flags of the street just where the water bubbles forth, and are spread on blocks of fallen masonry to dry. Water for cooking purposes is drawn here, and even the mules partake of the flow. Most of the mains are broken, and such chance sources of supply as this constitute one of the gravest menaces to the health of the city, which our American Red Cross is striving hard to shield from disease



The military school on the Paseo de la Reforma, the West Point of Guatemala. This view was taken after the shocks of December 25 and 29; the shock of January 3 did even greater damage

ing the ground lurched up under my feet and began to shake violently. An arc light overhead went out, flashed on, off, and on again. Wires short-circuited, spluttered and spit. The buildings on both sides rocked back and forth. My first thought was of the wires, and I darted into the nearest doorway to escape electrocution. Plaster and even brick began to rain down here and I ran back into the street to escape falling walls.

I perceived at this instant, that the only safe place in my immediate vicinity was the Plaza de Armas or the large central square of the city, and I set

off running thither at top speed. As I passed the American Club there tumbled from the big front entrance pell-mell into the street perhaps a dozen men who joined me, running toward the plaza. By the time we reached there people sketchily clad were pouring into it from all sides. The air was filled with a fine impalpable dust from the fallen adobe walls and a mist had drawn over the moon.

Slight tremors followed one after another almost without cessation. One felt instinctively that it was not over and all braced themselves for the next shock. At half past eleven the ground



The new market on the Plaza de Armas in front of the Cathedral.—The stalls were removed from the old market to this open space and business goes on in the new quarters as usual



Church of the Sanctuary.—In the foreground are temporary shelters with sides of matting and cloth and roofs of sheet iron



The Ministries of Fomento (Interior) and Hacienda (Finance) are housed in this shed in the Plaza de Armas



The Ministry of War occupies this open thatched shed facing the Plaza de Armas



Temporary chapel of wood and cloth hastily erected on the Cerrito del Carmen to shelter the figures of the Christ and the Virgin Mary rescued from the church, and the improvised altar. The congregation sits in the open

lifted a second time under our feet, jerked back and forth, and all but upset us. Buildings crashed down, wires short-circuited, and a choking dust again filled the air.

In view of the fact that their homes were being shaken down almost about their heads, the inhabitants were surprisingly calm. I saw very little hysteria and no disorder. The Indians fell on their knees when the second shock started, and began to pray. Lighted tapers were produced from somewhere and the drone of many prayers came from all sides. This second shock was far more severe than the first, and was the one which really destroyed the city. Subsequent shocks only brought down previously cracked and loosened walls. There followed an interval of minor quivers until ten minutes past two in the morning, when the third and last great movement of that long night shook the city, bringing down many more houses.

We all underestimated the damage that night. In the darkness there at the plaza we could see and hear only a small part of the destruction going forward, and it seemed that the city was weathering the assault fairly well. But dawn undeceived us as to the true condition of affairs. Guatemala City was in ruins.

I had been in San Salvador a week after the earthquake of June 7, and the destruction there was nothing compared with this. To be sure Guatemala is twice as large as San Salvador, but relatively, as well as actually, the destruction was greater. My first walks through the city showed that the streets were filled with the *débris* of fallen houses, tiles, bricks, plaster, adobe; façades were riven by tremendous cracks; interiors were exposed to view, the intimate details of the home opened to the curious; walls leaned at perilous angles; roofs hung by single beams; a tangle of wires draped the telephone poles; and everywhere people were huddled in

the streets waiting, waiting, waiting. Later in the day it was possible to learn further details of the catastrophe. Railroad and telegraphic communication with both the Atlantic and Pacific coasts was cut. Indeed it was not until forty-eight hours later that the first news of the disaster left the stricken city.

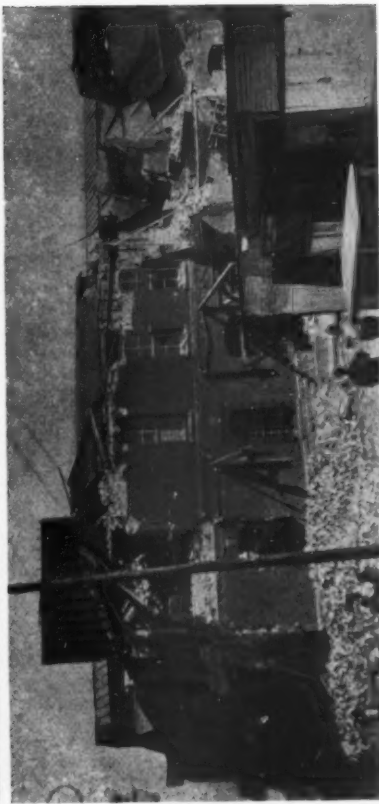
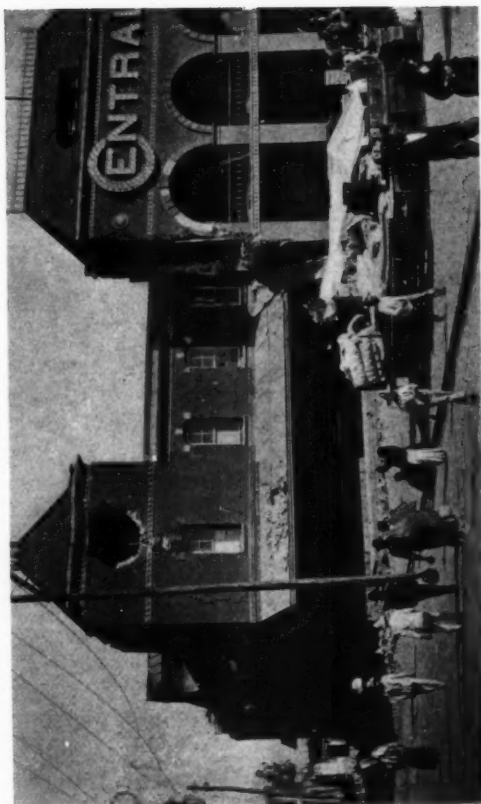
In the shocks of Christmas night about seventy persons were killed, mostly in the poorer quarters where the building construction was of adobe brick, of very inferior type, which crumpled like a house of cards. Considering the amount of damage done to the houses, the loss of life was surprisingly low. That it was not higher, may be laid to the fact that the first shock, although it drove everyone out of doors, actually brought few houses down.

The government at once took the situation in hand. Martial law was declared. Emergency tent dispensaries and hospitals were established in all parts of the city, and the free distribution of food (corn and beans) was begun. Business ceased while the people took up the work of moving their lares and penates into the streets, parks, squares, plazas, and open lots about the city. Wooden sheds were erected in the Plaza de Armas, and here the government departments, banks, and drug stores opened temporary offices. Gradually confidence returned; slight tremors continued but nothing violent; people ventured again into their homes to salvage their belongings from the wreckage—and then fell the next blow.

At two o'clock on the afternoon of December 29 the fourth heavy earthquake shook the city. This time the motion was horizontal, not vertical as in the case of the preceding three, and in consequence many more walls toppled over. And also because it was in the daytime, and people were in the houses, more were killed than on Christmas night. It is estimated that more



The British Legation after the shocks of December 25 and 29, and from the same point of view after the shock of January 3. Note the complete collapse of the second story in the later photograph. This last shock finished the work of destruction. What the others had spared, it shook down



The railroad station was damaged only slightly by the shocks of December 25 and 29. The hole in the tower was left by the clock dial when it fell out of the wall. It was thoroughly wrecked by the shock of January 3. The differences between these two pictures give an excellent idea of the relative destructiveness of the two shocks

than one hundred lost their lives in this one shock alone.

The inhabitants were now thoroughly terrified. No one could tell when the thing was going to stop. All waited for the volcanic eruption, which would relieve the tremendous subterranean pressure and alleviate the situation as it had done in San Salvador six months before, but none came. A great exodus began. People fled from the city by the hundreds, going for the most part to the cities on the Pacific coast-plain, Esquintla, Mazatenango, Quezaltenango, and Retalhuleu.

A new and gruesome situation developed. Hundreds of recently buried corpses were thrown from their vaults in the cemeteries and a pestilence therefrom was imminent. The government again acted with gratifying promptitude, however, and vast funeral pyres lighted the sky on that and succeeding nights. It is estimated that more than four thousand bodies were then disposed of.

Again the stricken city strove to compose itself. Slight tremors still continued but of diminished violence. A few shops opened here and there; fewer people left the city; confidence was returning a second time, when at twenty minutes to eleven in the evening of January 3, the city was rocked to its very foundations by the most tremendous shock of all. The earth lifted up as though pushed by some vast subterranean agency seeking outlet, held a moment thus, and then in terrific jerks and twitchings, settled back. By stopwatch this mighty movement lasted eleven minutes from its first cataclysmic second to its last dying tremor. And the destruction which it accomplished was more than that of all the others combined.

It is true, that the city had already

been fairly well loosened in its joints, but the earthquake of January 3 finished the work of destruction. What the others had spared, it shook down. The lofty twin towers of the cathedral were hurled to the ground like so many pill boxes. The massive pediment between fell in one solid block. The roof caved in. This edifice, the largest, costliest, and most magnificent in the country, is in ruins. Even the little chapel on the Cerrito del Carmen built three centuries ago, around which this third capital had been built, succumbed to this last violent movement of the earth. The roof fell in, and only with difficulty some of the faithful extricated the statue of the Christ and installed it in a temporary shelter outside. More than a hundred lost their lives in this last shock, bringing up the total of deaths to about three hundred. The city again was demoralized and thus it was when I left it five days later, coming down to Puerto Barrios on January 8 by the first train to leave the city after the last shock.

For the third time since its organization the capital of Guatemala finds itself in ruins. For the third time the work of relief and rebuilding must be undertaken.

Nearly one hundred thousand people are now living under temporary shelters of the flimsiest sort, matting, canvas, carpets, curtains, boards, sheet iron roofing, theatrical scenery, tables, beds, carts, wagons—even in the open; and if greater suffering and loss of life are to be averted, these people must be adequately housed before the rainy season in June. Money, building materials, and what might be called “alleviation and reconstruction” experts are required more than anything else in Guatemala’s present extremity. The need is urgent; the obligation ours.



Adult skimmer, type of revealing coloration, and young skimmer, type of concealing coloration

Common Sense and Animal Coloration

ON THE FUTILITY AND ABSURDITY OF BASING GENERALIZATIONS
REGARDING THE COLORATION OF ANIMALS FROM BUTTERFLIES
TO PRONGBUCKS ON OBSERVATIONS OF ONE ISOLATED,
HIGHLY SPECIALIZED GROUP OF FISHES

By THEODORE ROOSEVELT

SOME years ago I wrote a paper¹ discussing the question of concealing coloration among birds and mammals. It was done in elementary fashion, because in its groundwork essentials the question is one of kindergarten simplicity. But until writers have passed the kindergarten stage they are not fit to deal with the more advanced and intricate phases of the question. The kindergarten stage

is that in which reasonably intelligent persons learn that among the higher vertebrates there are thousands of species with concealing coloration, and thousands with revealing coloration. Until this fact is grasped in such manner that all discussion about it is seen to be as superfluous as discussion whether the earth goes around the sun, there is no use trying to deal with the more intricate developments of the matter. But as the question seems to invite confusion of mind among quite a number of per-

¹ *Bulletin of the American Museum of Natural History*, August, 1911.

Illustrations from photographs of exhibits in the American Museum

sons, it is worth while to take it up once more. But let my readers remember that I am dealing only with elementary, with kindergarten scientific matters.

Professor W. H. Longley, who has been working at the Marine Biological Laboratory, the Tortugas, Florida, has recently published an interesting paper¹ on animal coloration. The paper really consists of two wholly distinct parts. It is primarily a careful study of the colors and color changes of West Indian reef fishes; secondarily, it consists of a number of *obiter dicta*, and of recklessly drawn generalizations, on the subject of concealing coloration among the higher vertebrates.

As regards the first, the legitimate part of the study, I am not qualified to express an opinion. Professor Longley traverses and emphatically denies the justice of the conclusions of Professor J. E. Reighard² in his study of the same subject. Longley's studies have been so painstaking and so seemingly scientific that I would unhesitatingly accept them were it not that his very unscientific remarks on the general subject give just cause for inquiry as to whether a mind so biased may not unconsciously twist facts out of shape. As it is, before accepting his conclusions—and while fully admitting that on their face they seem at least in large part justified—I should like to get the careful judgment thereon of some expert like Professor Reighard, whose purpose obviously is to find out the truth wherever it leads, and who is not betrayed by any prejudgment into expressing or suggesting on kindred matters conclusions which have no warrant or basis in fact.

It is the second part of the paper,

¹ Studies upon the Biological Significance of Animal Coloration, *Journal of Experimental Zoology*, August, 1917. By W. H. Longley, of Goucher College, Baltimore, and the department of marine biology, Carnegie Institution of Washington, Tortugas, Florida.

² Jacob E. Reighard, professor of zoology at the University of Michigan. Author of *An Experimental Field Study of Warning Coloration in Coral Reef Fishes*, Papers from the Tortugas Laboratory, Carnegie Institution of Washington. Vol. 2, pp. 257-325.

containing these *obiter dicta* and generalizations on the general subject of animal coloration, with which I propose to deal. Inasmuch as Professor Longley has done me the honor to include me among the writers (Wallace, Weismann, Beddard, Reighard, Allen, Selous, Dewar and Finn) whose statements he regards as "diametrically opposed to the just inference from the facts" noted by him, for the purposes of this paper it will be sufficient for me to deal with his comments on the positions I myself have taken, save where, as in the case of Dewar and Finn, I have made the statements of others my own.

Professor Longley's position in the specific matter to which his words above quoted refer, well illustrates the peculiar twist in his mind, when the question of animal coloration is concerned. He writes³ that the statement that "movement will betray an animal even if protectively colored" is based upon "wholly illogical" reasoning, is "dia-

³ In Prof. Longley's paper, *Biological Significance of Animal Coloration*, in the section which discusses color change and states that various species of fish in moving from one environment to another change color to match, we find the following paragraph (p. 553):

"At this point one should refer for a moment to an idea one frequently encounters, and which seems in fair way to become an article of faith in the matter of animal coloration. The reasoning upon which it rests is wholly illogical, as the reader will observe. Sometimes it is simply affirmed *ex cathedra*: 'Absence of movement is absolutely essential to protectively colored animals.' (Beddard, '92, p. 90.) Sometimes it is stated with some attempt at justification: 'No color whatever could make a flying butterfly invisible to its enemies, because the background against which its body shows is continually changing during its flight, and, moreover, the movement alone is enough to betray it, even if it is of dull color.' (Weismann, '04, p. 74.) 'No observer of Nature can have failed to remark how the least movement on the part of an animal will betray its whereabouts, even though in color it assimilates very closely to its environment. . . . Thus in order that protective coloration may be of use to its possessor the latter must remain perfectly motionless.' (Dewar and Finn, '09, p. 200.) The same sentiment is expressed by Werner ('07), Selous ('08), Palmer ('09), and is quoted from Beddard with approval by Roosevelt ('10, p. 493). It reappears in Allen's ('11) review of Roosevelt's *Revealing and Concealing Coloration in Birds and Mammals*, yet is diametrically opposed to the just inference from the fact noted in the present section of this paper. It is one of the 'obvious' things, the number of which used in constructing theories of coloration is so great, that if all were eliminated, the skeleton remaining would be scarcely recognizable. It is so inconsistent with the fact that an unusually active fish, such as *Iridio birtatus*, which seems never to rest by day, possesses three color phases, which it changes appropriately as it passes from one environment to another, that farther comment is unnecessary."

metrically opposed" to the facts he has noted about reef fishes, and indeed is "so inconsistent" with what he has observed about one fish that "fuller comment is unnecessary." In other words, because Professor Longley finds, or thinks he finds, that protective coloration is of concealing value to certain coral reef fishes when in motion, therefore he takes the position that this observation on a small number of fishes necessarily proves that motion does not reveal protectively colored animals gen-

mammals. The facts as regards these are so obvious that any man of common sense *must* realize them, if he wishes to translate his theory into action. To deny them stands literally on a par with denying that two and two make four, or that a straight line is the shortest distance between two points.

No man can successfully shoot ducks, no man can successfully hunt big game, without treating as axiomatic the fact that sudden motion on the part of the hunter, if in view of his quarry will



Ptarmigan in summer and in winter plumage, types of concealing coloration

erally! Because in a very small field he believes that he has found a rule to obtain, he believes it must obtain everywhere. To use his own words, it would be impossible to take a more "wholly illogical" and therefore a more utterly unscientific position than this. Moreover, as to birds and mammals, and certainly as to most (and probably as to all) land reptiles and batrachians, Professor Longley is in actual fact wrong and the naturalists whom he criticises are right. In my articles to which he refers, I state that I am dealing only with birds and mammals, and Dewar and Finn¹ deal mainly with birds and

warn it, no matter what color his clothing may be. Professor Longley apparently thinks that this is treated as "obvious" without attempt to test it by trial; the real fact is that the trial test invariably and instantly establishes the fact to any human being of the smallest intelligence, so that thereafter he accepts it as being "obvious" in the same sense that it is "obvious" that if a chair is withdrawn from under a man who is sitting down he will fall to the floor—really, it is about as absurd to argue on behalf of one position as on behalf of the other. But, if Professor Longley must have "proof" of the obvious, I will explain that I have approached and observed many thousands

¹ *The Making of Species.* By Douglas Dewar and Frank Finn. J. Lane, London and New York.

of big mammals (not to mention many thousands of birds). I have found by indefinitely repeated experience that if I was entirely motionless I was very rarely observed; but that, no matter how carefully I chose a concealing coloration for my clothes, I was almost invariably revealed by motion—certainly by anything excepting stealthy motion—if within ken of the animal's vision. (In my writings I explicitly state that in order that concealing coloration may actually conceal an animal, there must be either lack of motion or stealthy movement.)

But there is no need to go after big game to test this fact. In the woods near my house wood frogs are common. I almost never see them unless they jump, and at the end of the first jump, when my attention has simply been attracted by the motion, I usually lose sight of the frog; but by moving around in the neighborhood I make it reveal itself by another jump, which I follow with my eye so that at its end I am usually enabled to place the frog. It is practically invisible when still, thanks to its color, and without regard to its color it is instantly seen when it moves. I am almost ashamed to have to recite such an "experiment"; a child of six who has been in the woods ought already to understand its truth. I shall quote a far keener and more experienced observer than I am. Mr. William Beebe,¹ speaking of the creatures of the tropic forests, says that "one of the most pronounced laws of the jungle" is that "the operation of protective coloration" depends entirely on immobility. "Clad in white, or in any conspicuous color, you may successfully hunt the wariest of jungle creatures, provided you select some suitable spot and remain quiet. Garbed in leaf green and the most invisible of khaki, the common agouti and the trustful trumpeter bird will easily escape you if you persist in

walking about or moving some part of your body or hands."

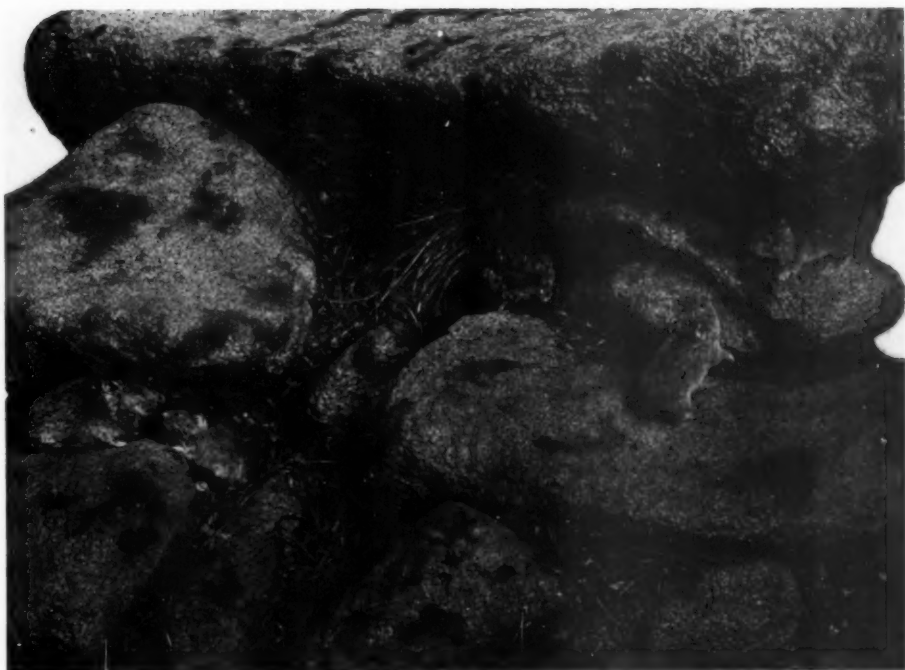
Professor Longley's thesis is that there is no warrant for belief in the existence of "conspicuousness of animals of high color," and he in effect denies "that there are conspicuous animals," and states that what he believes he has shown to be true of one group of fishes is inconsistent with the assumption that animals of high color "possess more than minimal conspicuousness under natural conditions." The marvelous logic of this last proposition is that the existence of concealing coloration on certain fishes is inconsistent with the assumption that such utterly different animals as ravens, flamingos, white pelicans, sable antelopes, white goats, and black squirrels with white tails "possess more than minimal conspicuousness under natural conditions." He announces the "essential truth" of Mr. Thayer's "hypothesis of concealing coloration."²

Mr. Thayer's book³ deals mainly with mammals and birds. Dewar and Finn in their capital book deal mainly with mammals and birds. I specifically stated that what I said referred only to mammals and birds. Longley's observations refer only to reef fishes. Thayer states that all animals which ever are prey or are preyed on (which means virtually all) are concealingly colored, coloration being a survival factor produced by natural selection; and the great majority of his illustrations and examples are drawn from among birds and mammals, as to which two classes he specifically and sweepingly lays down his—imaginary—law. I state that as regards birds

² *The Law that Underlies Protective Coloration*, Abbott H. Thayer, *The Auk*, Volume XIII, 1896, and *Smithsonian Yearbook*, 1898. Thayer's hypothesis states that animals are "countershaded," painted by nature darkest on those parts which tend to be most lighted by the sky's light and *vice versa*, and that this causes them to disappear, their colors and patterns becoming pictures of such background as one might see if the animal were transparent.

³ *Concealing Coloration in the Animal Kingdom*, being a summary of Abbott H. Thayer's discoveries. By Gerald H. Thayer. The Macmillan Co., New York, 1909.

¹ Ornithologist at the New York Zoological Park. Author of *Tropical Wild Life in British Guiana*, from which the quotation following is taken (p. 73).



Pika, type of concealing coloration

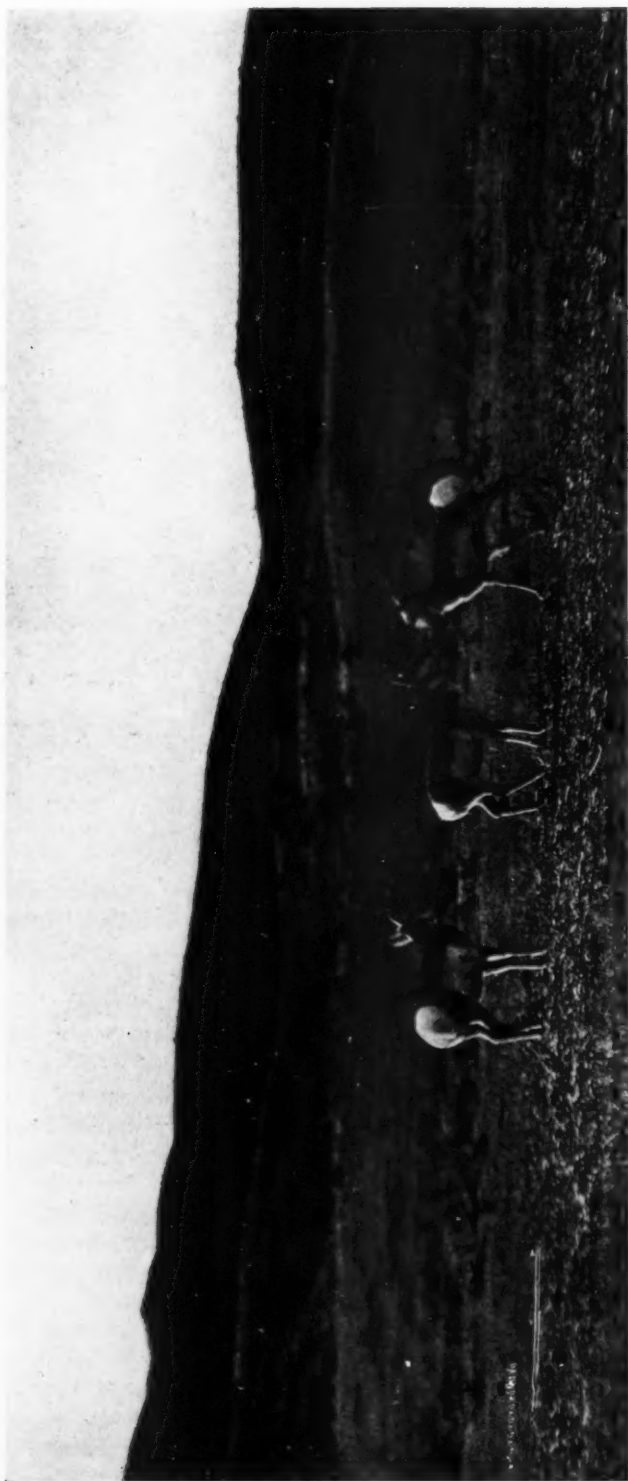
and mammals there are very many species where the adults or the young, or the adult individuals of one sex, are concealingly colored, this coloration doubtless being a survival factor, and very many others as to which this is not so; and that among the latter are numerous animals with a conspicuous or advertising or revealing or directive coloration—I care not which term is used.¹ This is the point at issue.

Professor Longley apparently takes the ground that animal conspicuousness does not exist in nature. He says he is “impressed by the uniform absence of effort to demonstrate that conspicuousness exists,” by various observers, including myself, and adds, “that the conspicuousness so lightly assumed is a subjective phenomenon is capable of demonstration,” and proceeds to “demonstrate” that I am in error when I speak of a *prongbuck* as conspicuous

by saying that other observers have mistakenly thought *red fish* to be conspicuous! I would really like to know just how Professor Longley regards this as a “demonstration.” He refuses to “grant that there are conspicuous animals,” and “demonstrates” that such animals as prongbucks are inconspicuous by saying that red fishes live in the dark and come to the open surface only by night, having nocturnal feeding habits! Would he regard this statement as to red fishes to be “demonstrated” to be erroneous by my pointing out that *red birds*, such as tanagers, cardinals, flamingos, and macaws, are diurnal?

Now, as to the failure to “demonstrate” that “conspicuousness exists,” as in the case of the prongbuck; the trouble is in demonstrating the self-evident. If I were asked to “demonstrate” that a black coal scuttle on a white sheet, or a crow on a snowbank, is conspicuous, I should be rather puzzled to know where to begin; and a Rocky Mountain goat or a cock ostrich is normally as conspicuous as the coal

¹ There has, hitherto, been no successful effort to answer my articles in which I discussed Mr. Thayer's sweeping theories; Professor Longley certainly does not; and if he will turn to Mr. Beebe's book above mentioned (pp. 104–108), he will find, in a purely incidental allusion to coloration, the kind of recorded observation which really does help to throw a little light on the subject.



Photograph by M. P. Skinner

PRONGBUCKS, WITH WHITE RUMP DISKS DISPLAYED; EXAMPLES OF REVEALING COLORATION

There is probably no such thing among mammals and birds as a coloration which under all the conditions of the wearer's life is always either completely revealing or completely concealing; but it may be one or the other, 999 times out of the thousand. On the plains of the Little Missouri I could see the prongbuck when I was half a mile away or more

scuttle on the sheet. There is probably no such thing among mammals and birds as a coloration which under all the conditions of the wearer's life is always either completely revealing or completely concealing; but it may be one or the other, 999 times out of the thousand. Out in the Bad Lands of the Little Missouri I once saw a raven against a coal seam in a cliff, and its color for the moment was concealing; and once at dusk a poor-will lit on the bare veranda beside me, and its coloration was for the moment revealing. Yet under all ordinary circumstances, the direct reverse is true in each case; and it is just as absurd to deny that a raven (or a crow, or a grackle, or a cow bunting, or a white egret, or a full-grown black and white skimmer on its nest) is revealingly colored and conspicuous, as to deny that a whip-poor-will (or a nesting grouse, or a desert lark, or a fledgling skimmer) is concealingly colored and inconspicuous.

However, I will attempt the "demonstration." The pronghorn on the plains of the Little Missouri was conspicuous exactly as a wildebeest on the plains of the Athi or the Guaso Nyiro was conspicuous. If camped for any length of time in their haunts, I always grew to know the probable range of each group of pronghorns or wildebeests, as the case might be; and then there was never the slightest difficulty in seeing them. Around my ranch there were occasions when a small herd, or a couple of pronghorns, or a single animal would settle down in a certain locality; and then it was impossible not to see them if I went thither; I could always find the party of does and kids, or the solitary old buck, or the two yearlings, which I expected to find. In the same way, in Africa, in the camps where we spent a considerable length of time, there would often be wildebeest stationary in the locality; in one instance which I remember there was a herd which haunted the neighborhood

of a hill and, on the other side of camp, an old bull which kept with a herd of gazelles, and I could always find either without difficulty. The coloration of the prongbuck made me see it even when I was half a mile away or more; the wildebeest struck my eye when I was nearly a mile away; and under such circumstances to deny that the animal was "conspicuous" seems to me to represent quibbling over terminology, and not the effort to appreciate facts and to draw therefrom honest conclusions.

Is the above not a "demonstration"? Conspicuousness is of course relative, just as is the case with speed. On the plains where the pronghorn dwelt there were skunks and jack rabbits. The jack rabbits ran faster than the skunks. I assert this in the "sweeping" and "reckless" manner to which Professor Longley objects. The fact was "obvious"—again to use the word to which Professor Longley objects. I never "demonstrated" this fact, however, any more than I "demonstrated" the conspicuousness of the prongbuck. One fact stood just as much in need of demonstration as the other, and no more so. Whoever needed to have either fact "demonstrated" to him would have quarreled with Æsop or Uncle Remus about the relative running capacities of a rabbit or hare and a tortoise.

There must be a foundation of common sense for every scientific structure. Until a man understands that a crow is conspicuous and a wood frog inconspicuous (and that there are very many—doubtless thousands—of other animals as revealingly colored as the crow and of yet others as concealingly colored as the frog), he has not learned the A B C of animal coloration; and if he perversely refuses to learn the alphabet his future studies will not tend to enlightenment.

Mr. Thayer's book is delightfully written and contains valuable artistic truths; just as Milton's account of the creation of life in *Paradise Lost* con-

tains noble poetry; and as regards mammals and birds Thayer's book contains just about as much new scientific truth as does *Paradise Lost*. To treat his book as in this respect superior to such a book as Dewar and Finn's, stands on a par with ranking the noble Miltonic poem of the creation as scientifically above Darwin's *Descent of Man*. Until we have attained the elementary knowledge necessary in order to understand that the facts above outlined have been amply "demonstrated," further biological discussion does not tend to edification.

My discussion¹ of revealing and concealing coloration among birds and mammals covers but a tiny corner even of the question of animal coloration; but I do not think that it is possible to controvert my main thesis, which is, that as regards these higher vertebrates, concealing coloration (with or without countershading as a basis), as a survival factor working through natural selection, has been of trivial consequence in producing the special color patterns on the great majority of birds and mammals; that it has in an immense number of cases been wholly inactive, so that in very many of these cases the animals are extraordinarily conspicuous in nature at almost all times, including the vital moments of their lives; and that in most of the large number of cases where it has actually been a factor it has merely set limits of conspicuousness, sometimes very narrow, sometimes very broad, which must not be exceeded, but within which innumerable tints and patterns are developed, owing to some entirely different slant of causation.

I have not tried to deal with reptiles and batrachians as a whole, nor at all with fishes and invertebrates. I am very confident that as regards some common land reptiles and insects which

I continually come across—black snakes for instance, numbers of black or showily colored beetles, and woolly caterpillars which are boldly marked with black and red or which are white—the coloration has not the slightest concealing, and probably has a revealing, quality; that they are conspicuous.

I am quite prepared to find that the reverse is the case as regards many, or even the vast majority, of the lower forms of life, including especially all those in which the individuals undergo a rapid change of color corresponding with the change in the color of their backgrounds. It seems to me utterly unscientific to try to generalize, negatively or affirmatively, about all animals from observations on one highly specialized group; and above all to try to apply deductions from observations made on such a group as that of the coral reef fishes to groups of animals like prongbucks or white goats, or ostriches, or crows, or white egrets, or scarlet tanagers, where practically every condition is entirely different. In the bay beside which I live are mollusks with white, black, dark green, slate, gold, silver and brown shells; and the pebbles on the beach have about as varied colors; but I do not try to generalize from the shellfish to the pebbles or *vice versa*.

There is ample room for genuinely scientific study in order to find out what coloration laws, if any, apply universally to Long Island Sound shellfish, to coral reef fishes, to land insects, to reptiles, to forest and desert birds, and to mountain and plains mammals; and what laws apply only in one or another group. But in order that our studies shall be to good purpose, we must be willing to face all the elementary facts, including our ignorance as to most of them; and when once these elementary facts have been shown to be obvious, we must not waste time in re-investigating them without sufficient cause.

November 15, 1917.

¹ See *Bulletin of the American Museum of Natural History*, August, 1911; *African Game Trails*, Scribner's, 1910, Appendix, pp. 491-512; also *Life Histories of African Game Animals*, Scribner's, 1914, pp. 54-148.

The Red Cross and the Antivivisectionists¹

AN APPEAL TO THE FAMILIES AND FRIENDS OF OUR HEROIC
TROOPS AND TO THE COMMON SENSE OF
THE AMERICAN PEOPLE

By W. W. KEEN, M.D.

Emeritus Professor of Surgery, Jefferson Medical College; Major Medical Reserve Corps,
United States Army

FIRST of all let me make two facts clear.

1. This paper has been written entirely on my own responsibility and not at the suggestion directly or indirectly of the Red Cross. I have been moved to write it solely in the interest of our brave soldiers, and especially because their sufferings and lives are involved in the suit against the Red Cross by the antivivisectionists to prevent the use of \$100,000 of the Red Cross funds in such beneficent life-saving researches.

2. The Red Cross as an organization is neither an opponent, nor an advocate, nor a defender, of vivisection. It states officially that the *supreme* aim of the Red Cross is to *relieve human suffering* [and it might well have added "and to save thousands of human lives"].

"The War Council was advised from the ablest sources available that an immediate appropriation for medical research would contribute to that end. The War Council could not disregard such advice."

They then refer to the many unsolved medical and surgical problems that have arisen from wholly new conditions and methods of warfare. Letters from a number of my own surgical friends in France emphasize and the medical journals teem with papers on these new problems. They relate to the treatment of the horribly infected wounds—and practically *all* wounds are of this kind—never met with in civil surgery; to the treatment of "trench fever"—a peculiar form of fever never

before seen; of "trench heart"; of "trench foot," often followed by lock-jaw; of "trench nephritis" (inflammation of the kidneys); gas gangrene; tetanus; shell shock; poisonous gases; fearful compound fractures, especially of the thigh, etc. Every man enabled to return to active duty as a result of solving these problems helps to win the war. Every man who dies, or is permanently disabled because of our ignorance, hinders our winning the war.

It must be remembered that our surgeons, physicians, and physiologists over there are the very flower of the American medical profession. These fine men, under the supervision of the Medical Staff of the United States Army, superintend all the work. Nothing is done that has not the direct approval of Brigadier General A. E. Bradley, Medical Corps, U. S. Army.

Experiments on animals form a necessary but a minor feature of the researches.

"The animals used are principally guinea pigs, rabbits and white rats. If operations causing pain to animals are performed, anesthesia is used."

This certainly does not suggest "cruelty" or "torture."

I appeal to the common sense of the American people and especially to the families and friends of our brave soldier boys: Which do you prefer, (1) That our soldiers shall be protected from attacks of these new (as well as of the familiar) diseases, their sufferings lessened or even prevented, and

¹ Quoted from *Science*, February 22, 1918, with slight additions by Dr. Keen.

their lives saved, or (2) will you insist that not a single guinea pig, rabbit, or rat shall suffer the slightest pain or lose its life, in researches to lessen the suffering and save the lives of our soldiers?

Remember, if you choose the second you deliberately condemn your son, brother, or husband to sufferings far beyond any suffering of these animals. In many cases, as I shall show, you will condemn your dear one to death, and in some cases a horribly painful death.

In the "Bill of Complaint" of the antivivisectionists, seven grounds of opposition to vivisection are mentioned. The sixth reads as follows:

"That although it [vivisection] has been practised for many years, *nothing has been discovered by means of it that is at all beneficial to the human race.*"

This is the crux of the whole matter. If this were true I would vigorously oppose vivisection myself.

I entered upon my medical studies in 1860. I took part in the horrible surgery of the Civil War—as we now know it was. I have taught anatomy and surgery to not far from 10,000 students. I taught and practised the old dirty surgery—the only kind we then had—up to October 1, 1876. Since that date I have practised and taught the new antiseptic surgery, which has been created by researches similar to those now proposed. Since the Great War began I have diligently studied the newest surgery. I submit, therefore, that I may be presumed to be fairly familiar with these three stages of surgery. Let me give now a few examples of some of the things that HAVE "been discovered by it [vivisection]" and that *are* "beneficial to the human race."

I may remark in passing that animals themselves have benefited by the same means, almost, and possibly quite as much as the human race.

1. *Typhoid Fever*.—This has been one of the historic scourges of armies.

In 1880 the bacillus—the cause of the fever—was discovered. It was soon proved that the disease was spread through infected milk, infected water, and very largely by the house fly. The last, after walking over the excrement of a typhoid patient, and then walking over our food, conveys the disease. Prevention of contamination by these three means—sanitary measures based on the discoveries of bacteriology—prevents the disease to a large extent. But our real triumph over the disease was not achieved until lately.

I may here call attention to the fact that the antivivisectionists entirely reject bacteriology, a science which has disclosed to us the causes of many diseases, and has enabled us to prepare antitoxins to neutralize the poisons developed by these bacteria. Without bacteriology the physician and the surgeon today would be as helpless as a mariner without a compass.

	Cases	Deaths
During the Civil War typhoid fever resulted in.	79,462	and 29,336
In the Boer War there were	58,000	" 8,000
(In that war the total number of deaths was 22,000. Typhoid alone, therefore, was responsible for more than one third of all the deaths!)		
In our war with Spain there were	20,738	" 1,580
Our Army numbered 107,973 men. Therefore every fifth soldier fell ill with typhoid in 1898! Over 86 per cent of all deaths in this war were due to typhoid!!		

During the Boer War imperfect attempts were made to control typhoid by an antitoxin similar to that against diphtheria, which has saved such multitudes of children. Gradually the method has been improved so that in our army it was at first recommended as a voluntary protection (1909). The

results were so favorable that in 1911 it was made compulsory. It has been said that it should still be voluntary. But as every case of typhoid imperils the health and life of multitudes we surely have a right to make it compulsory so as to protect all the rest. All that is necessary to prove this is to look at these tables of cases and deaths in our Army and Navy.

TYPHOID FEVER IN THE UNITED STATES ARMY

Year	Cases	Deaths
1906	210	12
1907	124	7
1908	136	11
1909	173	16
1910	142	10
[VACCINATION MADE COMPULSORY]		
1911	70	8
1912	27	4
1913	4	0
1914	7	3
1915	8 ¹	0

TYPHOID FEVER IN THE UNITED STATES NAVY

Year	Cases	Deaths
1909	189	17
1910	193	10
1911	222	15
[VACCINATION MADE COMPULSORY]		
1912	57	2
1913	22	4
1914	13	0
1915	15	1

On the Mexican border, though the fever was rife near the camps, only *one man* out of 20,000 troops, a civilian, who unfortunately escaped vaccination, fell ill with it.

Now let us see the results in the armies in the present war.

In the British armies, on March 1, 1917, Mr. Forster, Under Secretary for War, stated in the House of Commons that

The last weekly returns showed only twenty-four cases in the four British armies in France, Salonica, Egypt and Mesopotamia. He added that the total number of cases of typhoid fever in the British troops in France

down to November 1, 1916, was 1,684, of paratyphoid² 2,534, and of indefinite cases, 353, making a total of 4,571 of the typhoid group.

Now the English armies number at least 5,000,000. If they had suffered as our Army did in 1898 there would have been 1,000,000 cases! In fact there have been less than 4,600! Besides that, the percentage of fatal cases in the inoculated men was 4.7 per cent. in the uninoculated 23.5 per cent; and perforation of the bowel, the most dangerous complication, occurred *six times more frequently* among the unvaccinated than among those who had been protected. In the British armies the antityphoid vaccination is still voluntary but more than 90 per cent have sought its protection. If it had been compulsory, hundreds of the 4571 *who died would have been saved!*

In our own Army in more than four months (September 21, 1917, to January 25, 1918), a period one month longer than our war with Spain (the Surgeon General's Office gives me the official figures), we have had an average (*i. e.*, every day of these four months) of 742,626 men in our cantonments and camps. These men have come from all over the country, in many cases from where autumnal typhoid was reaping its annual harvest, in practically all cases unprotected by vaccination. Between these two dates there have been 114 cases of typhoid and 5 of paratyphoid. *Had the conditions of 1898 prevailed there would have been 144,506 cases instead of 119 in all!* The reason is clear. The men were all immediately vaccinated against typhoid, paratyphoid and smallpox.³

Besides this as soon as the antityphoid inoculation was completed the number of cases rapidly fell and from December 14 to February 15—9 weeks

² A form of fever caused by a bacillus somewhat similar to the typhoid bacillus but causing a much milder infection.

³ Of the last disease, there have been only 4 cases, all unvaccinated.

¹ Four in the United States; 4 in Hawaii.

—there have been only 6 cases of typhoid and one of paratyphoid among probably now nearly 1,000,000 men! Truly marvelous!

Now all this is the *direct result of bacteriological laboratory work*. Was it not worth while? Has it not "benefited the human race"? Are you not glad that *your son* is thus protected?

I may add that the German armies show a similar absence of typhoid. I have seen no figures but only general statements.

Tetanus or "*Lock-jaw*."—Few people realize what terrible suffering this disease causes. The mind of the patient is perfectly clear, usually to the very end, so that his sufferings are felt in their full intensity. All of my readers have had severe cramps in the sole of the foot or calf of the leg. The pain is sometimes almost "unbearable." In tetanus not the muscles of the jaw alone are thus gripped, but the muscles all over the body are in cramps ten or twenty-fold more severe, cramps so horrible that in the worst cases the muscles of the trunk arch the body like a bridge and only the heels and head touch the bed!

Never shall I forget a fine young soldier during the Civil War who soon after Gettysburg manifested the disease in all its dreadful horror. His body was arched as I have described it. When at intervals he lay relaxed, a heavy footstep in the ward, or the bang of a door, would instantly cause the most frightful spasms all over his now bowed body and he hissed his pitiful groans between tightly clenched teeth. The ward was emptied, a half-moon pad was hung between the two door-knobs to prevent any banging; even the sentry, pacing his monotonous steps just outside the ward, had to be removed beyond earshot. . . . The spasms became more and more severe, the intervals shorter and shorter; it did not need even a footfall now to produce the spontaneous cramps, until finally a cruelly merciful attack seized upon the muscles of his throat and then his body was relaxed once more and forever. He had been choked to death.

Do you wonder at the joy unspeakable which we surgeons have felt of late years as we have conquered this fearful dragon? In 1884 the peculiar germ, shaped like a miniature drumstick, was discovered. Its home is in the intestines of animals, especially of horses. The soil of France and Belgium has been roamed over by animals and manured for over 2,000 years, even before Julius Cæsar conquered and praised the Belgians. The men in the trenches and their clothing are besmeared and bemired with this soil, rich in all kinds of bacteria, including those of tetanus, gas gangrene, etc. When the flesh is torn open by a shell, ragged bits of the muddy clothing or other similarly infected foreign bodies are usually driven into the depths of the wound. Now the tetanus bacilli and the bacilli of "gas gangrene" are the most virulent of all germs. It takes 225,000,000 of the ordinary pus-producing germs to cause an abscess and 1,000,000,000 to kill, while 1,000 tetanus bacilli are enough to kill. This readily explains the frightful mortality from tetanus during the Civil War. It killed 90 patients out of every hundred attacked.

In the early months of the Great War the armies suddenly placed in the field were so huge that there was not a sufficient supply of the antitoxin of tetanus. Hence a very considerable number of cases of tetanus appeared. Now it is very different. At present every wounded soldier, the moment he reaches a surgeon is given a dose of antitetanic serum. As a result, *tetanus has been almost wiped off the slate*. I say "almost," because to be effective the serum must be given within a few hours. The poor fellows who lie for hours and even days in No Man's Land cannot be reached until too late. All the surgeons on both sides concur in saying that tetanus, while it still occurs here and there, has been practically *conquered*.

Every step of this work has been accomplished by the bacteriologists and

the surgeons working together in the laboratory and the hospital. Would you seriously advise that no such experimental researches should have been carried on and that your boy should suffer the horrible fate of my own poor Gettysburg boy? Confess honestly, are not these and other similar researches to be described as humane?—as desirable?—nay, as imperative?

Nay, more, "We feel," say forty-one of our medical officers on duty in France, "that any one endeavoring to stop the Red Cross from assisting in its humanitarian and humane desire to prevent American soldiers from being diseased, and protecting them by solving the peculiar new problems of disease with which the Army is confronted is in reality giving aid and comfort to the enemy." But the antivivisectionists declare that bacteriology is false—that such vaccination is "filling the veins with 'scientific filth' called serum or vaccine"! They are doing their best to persuade our soldiers not to submit to any such "vaccination"!

Smallpox.—The word vaccination leads me to say a word about smallpox. I confess that I was amused by a recent paper in an antivivisection journal entitled "Vaccination as a Cause of Smallpox"! During the last year hundreds of thousands of soldiers have been vaccinated against smallpox. Surely there should have been some cases of that disgusting disease if it were caused by vaccination.

But what are the facts? I have just received the Report of Surgeon General Gorgas for 1917. The section on Smallpox reminds one of the celebrated chapter on "Snakes in Ireland." On p. 81 on Smallpox in the Army in the United States, I read "No cases of smallpox occurred within the United States proper during the year." On p. 175, I read "No cases [of smallpox or varioloid] occurred in the islands" [among the American troops in the Philippines]. On p. 188, I read under Small-

pox that "nine cases occurred during the year" [among the Philippine Scouts].

My friend and former student, Dr. Victor G. Heiser, as director of health in the Philippine Islands for years, vaccinated over 8,000,000 persons without a death—and with what result? In and around Manila the usual toll of smallpox had been about 25,000 cases and 6000 deaths annually. In the twelve months after his vaccination campaign was finished there was *not one death* from smallpox.

Per contra, in 1885 in Montreal, as stated by Osler, one Pullman porter introduced smallpox into a largely unvaccinated city. There followed 3164 deaths and enormous losses to the Montreal merchants.

But why say more? We all know that a single case in any community causes every intelligent person to be protected by vaccination.

Gas Gangrene.—One of the terrible and new surgical diseases developed by this war is called "gas gangrene." It has no relation to the poisonous gases introduced by the barbarous Germans at Ypres. About twenty-five years ago Professor W. H. Welch, of the Johns Hopkins Hospital, discovered a bacterium which produced gas in the interstices between and in the muscles. This bacillus does not occur in Great Britain. I never saw a case of gas gangrene in the Civil War, and but one case since then in civil practice. On the contrary in Belgium and France in the soil and, therefore, on the clothing and on the skin of the soldiers these bacilli abound. From what Bashford calls the "cesspool of the wound" the germs travel up and down in the axis of the limb. If the gas escapes from a puncture it will take fire from a match. Gas has been observed within five hours. An entire limb may become gangrenous within sixteen hours. If the whole limb is amputated the gas may be so abundant that the limb will float in water! Death is not long delayed.

Now your son in France runs a very serious risk of becoming infected with this deadly germ. Would you be willing positively to forbid any experiments on animals which could teach us how to recognize this infection as early as possible? Would you forbid any experiments which might teach us how to conquer or better still to prevent this virulent infection and save his life? Which would you prefer should suffer and very possibly die, a few minor animals or your own son? If a horse or a dog or even a tiny mouse can help in this sacred crusade for liberty and civilization, if it even suffers and dies, is it not a worthy sacrifice? Should they be spared and our own kith and kin give up their lives?

I need not wait for a reply! I am sure you would say "My boy is worth 10,000 rabbits or guinea pigs or rats! Go on! Hurry, hurry! and find the remedy." That is true humanity which will save human lives even at the expense of some animals' lives.

Now see the result. By careful observation and experiments with different remedies the surgeons have discovered valuable methods of treatment. But very many still die. Prevention is always far better than cure. At the Rockefeller Institute Drs. Bull and Ida W. Pritchett have discovered a serum which in animals prevents this gas gangrene and yet does no harm to the animal. It is now being tried on the soldiers in France.

Again I ask: Is it not our duty even to *insist* on such experiments so that our troops may be spared the dreadful suffering and even death following this virulent infection? If the Bull-Pritchett serum proves ineffective should not our efforts be redoubled? The common sense of the American people will reply: "Yes, by all means. You will be recreant to humanity and to your duty if you do not."

Modern Surgery.—"Lister," in Howard Marsh's fine phrase, "opened the

gates of mercy to mankind." Pasteur and Lister are the two greatest benefactors of the human race in the domain of medicine. I am not sure but that I might even omit the last five words.

The revolution which Lister produced in surgery is so well known to every intelligent person that I need say only a few words. Forty years ago a wholly new surgical era was inaugurated by Pasteur and Lister. In the Civil War there were recorded 64 wounds of the stomach and only *one* recovered. Otis estimated the mortality at 99 per cent. In more than 650 cases of wounds of the intestines there were only 5 cases of recovery after wounds of the small bowel and 59 from wounds of the large bowel—together only 64 out of 650 recovered, *i. e.*, more than 90 out of every 100 died!

The complete statistics of the present war cannot be tabulated and published for some years. I give, however, the result of one series of abdominal gunshot wounds as a contrast, on a far larger scale and in far worse wounds. Out of 500 such operations, 245 *recovered!* and only 255 died. Contrast 51 per cent of deaths in these wounds with mutilation and infection unutterably worse than in the Civil War, with 99 per cent of deaths, according to Otis.

Is not this a triumph of bacteriological and surgical research? Would you prohibit similar researches now when your boy's life may be saved by them?

Is not this one of the things that *have* "been discovered" by vivisection and has not such change in surgical treatment been of "*benefit* to the human race"? In all honesty would you be willing to have your son treated as I myself (may God forgive me!) ignorantly treated hundreds during the Civil War?

This advance I not only *think* and BELIEVE, but also I KNOW is due to

Pasteur and Lister and their followers. I know it by personal experience just as you know the high cost of living, the shortage of sugar, and the scarcity of coal.

The bacteriology which the antivivisectionists scorn and reject I know is the CORNER-STONE of modern surgery. Before Lister's day out of 100 cases of compound fracture 66 died from infection. Now the percentage of deaths is *less than one* out of 100. Before Lister my old master in surgery, Dr. Washington L. Atlee, one of the pioneers in practising ovariectomy, lost 2 out of every 3 patients—now only 2 or 3 in 100 die. Before Lister we never dared to open the head, the chest or the abdomen unless they were already opened by the knife, the bullet or other wounding body. Now we open all of these great cavities freely and do operations of which the great surgeons of the past never dreamed in the wildest flights of their imagination. Could they return to earth they would think us stark crazy until they found that the mortality was almost negligible and the lives saved numbered hundreds of thousands.

I have given but a few instances of the many wonderful benefits which have resulted from medical research in every department of medicine. But I believe they are sufficiently convincing. I should have been glad to tell the story of tuberculosis, syphilis, the bubonic plague, yellow fever, malaria, the hook-worm disease, diphtheria, typhus fever, cerebrospinal meningitis, Malta fever, leprosy, and many other diseases, every one of which has had its progress stayed, its victims rescued, its toll of human lives cut down enormously, sometimes to one half or less, by researches similar to those which will be conducted in France. Most important and life-saving researches on surgical shock already have been made by Porter, Cannon, and others. Ought these

to be abandoned and our soldiers left to perish when we can save their lives?

I can sympathize with the deep feelings of those who wish to spare pain to animals, but is it not a higher and more imperative, a holier sympathy that has spared and will spare pain eventually to human beings and also to other animals in uncounted numbers?

Do you wonder that after more than forty years of steady practice, teaching and writing I assert, conscious of the great responsibility of my words, that "I regard experimental research in medicine as a medical, a moral and a Christian *duty* toward animals, toward my fellow men, and toward God."

There is so much yet to be learned, chiefly by experimental research! So many devoted lives to be saved to our country and to mankind if we only knew how! Do you wonder that I am in dead earnest?

Finally. What have the antivivisectionists themselves done to diminish sickness and save life?

A. In animals? Absolutely nothing.

In spite of the enormous ravages of animal diseases causing enormous suffering to animals and costing this country \$215,000,000 every year, not a single disease has had its ravages diminished or abolished as a result of anything *they* have done. They have not even tried. But medical research is saving every year thousands of animals from anthrax, hog cholera, chicken cholera, Texas fever, and other diseases.

B. In human beings? Absolutely nothing. I do not know a single disease of human beings which has had its ravages checked, abated or abolished by any work ever done by the antivivisectionists. Again, they have not even tried.

The only thing they *have* done has been to throw as many obstacles as possible in the path of those who are striving to benefit both animals and men.

This present suit is characteristic.



Photograph by John Rowley

STELLER'S SEA LIONS ON AÑO NUEVO ISLAND, CALIFORNIA

[See illustrations on pp. 244 and 245 with note, regarding the group of Steller's sea lions in the new Museum of the California Academy of Sciences, San Francisco]

The Sea Lions of California¹

Py EDWIN CHAPIN STARKS

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LITTLE as they look like lions, the sea lions of the Pacific coast have the assertion of such resemblance firmly fixed upon them by their name. Nor is their resemblance to wolves any more apparent, although the early Spanish residents in California evidently so imagined, for they called them sea wolves. They are sometimes called hair seals to distinguish them from their first cousins the fur seals, but the name "seal" applied to either the fur seal or the sea lion is rather unfortunate, for they are very different from the true seals. Perhaps of all the names that have been applied to them that of "sea bears" is most appropriate. This name indicates their true relationship, for they are thought to be more closely related to the bears than to any other strictly land animal. They are rather bearlike in their movements. As the old males go on their swinging amble across the rocks, their manes bristling, their heads swaying from side to side, they have a striking resemblance to bears.¹

¹ The group to which these animals belong—the Pinnipedia—includes the sea lions, fur seals, walruses, sea elephants, and true seals. This group has been divided into three families, the first of which contains the true seals and sea elephants, and the second, the fur seals and sea lions, the walruses forming the third. The fur seals and the sea lions are closely related to each other, and form a family known as the eared seals. They are separated from each other chiefly on account of the character of the body covering, the fur seal having an under fur that the sea lion lacks.

The eared seals have small external ears. Their hind flippers instead of pointing straight back are bent forward at the ankle joint like the hind feet of a bear, and have a long web extending beyond the claws. There are claws on the hind feet only. In the fore feet the web extends far beyond the bones of the toes. The flippers are large enough to raise the body completely from the ground, and enable the animal to climb steep rocky cliffs. They can attain considerable speed over the ground in a sort of an awkward trot. The neck is long and the head may be held erect at an angle with the body.

On the California coast are two species of sea lions, Steller's sea lion (*Eumetopias jubata*) and the California sea lion (*Zalophus californianus*). Steller's sea lion is much the larger, the males reaching a length of fourteen feet and the weight of a ton, while the males of the California sea lion do not exceed eight or nine feet in length. The females always are very much smaller.

Steller's sea lion is found from Bering Strait southward to the Santa Barbara Islands. The range of the California sea lion has not been well made out. It is found along the entire California coast and indefinitely northward. Its southern range is at least to Cape San Lucas and the Gulf of California. Although these two forms mingle along the Pacific coast for several hundreds of miles, their breeding ranges scarcely overlap, for the southernmost rookery of Steller's sea lion is said to be on Santa Rosa Island, while the northernmost rookery of the California sea lion is said to be on San

The true seals, of which the common leopard seal, or harbor seal, found on both our Atlantic and Pacific coasts, is an example, are more aquatic than the eared seals, the flippers being much better adapted to life in the water than on land. The flippers are very short, and both the fore and hind ones are armed with claws, beyond which the web scarcely extends. The hind flippers cannot be bent forward at the ankle joint. The true seals are very helpless on land. They cannot raise themselves from the ground, but progress by a series of short hitches. The neck is short and there are no external ears. They do not venture very far from the water's edge.

The old zoölogists naturally believed that the seals and sea lions bridged the gap in the relationship between the land mammals and the purely aquatic, whalelike mammals. It is now apparent that the whales are descended from a group entirely different from those that gave rise to the seals, so while the seals and their relatives are not a link between the land and marine mammals they are, nevertheless, intermediate in the use of their limbs, for these are adapted for use both on land and in water.

¹ Illustrations from photographs by the Author and Mr. John Rowley.

Miguel Island, which is only a few miles north of Santa Rosa Island.¹

The sea lion seen by the visitor to zoological park and circus, is almost always the female of the California sea lion, although occasionally a small bull of that species, or a cow of Steller's sea lion, is seen. A large bull of Steller's sea lion never has been taken alive. Once on one of the Santa Barbara Islands a boat's crew of fifteen men succeeded in getting a rope around the neck of a sleeping bull of this species, but they might as well have lassoed a locomotive. The sea lion kept the rope as a souvenir.

¹ I record this with considerable doubt and hesitation, and emphasis on the words "said to be." I have personal knowledge that these rookeries are as recorded for the above species, and also that the several rookeries I have visited south of Santa Rosa were only of the California sea lion, but for the coast between San Miguel Island north to Año Nuevo Island, I have only hearsay evidence obtained from men who apparently were able to distinguish between the two species. Among these men, however, was a boatman who for many years has made a business of catching sea lions on the Santa Barbara Islands for zoological parks and menageries, and who knows the sea lions probably better than anyone else on the coast. The Santa Barbara Islands include the above islands and lie just below Point Conception, where the coast bends sharply eastward, and where a break between the breeding ranges of the two species logically might occur, for here several subtropical aquatic forms find their northernmost range.

There are several rocky islets along the California coast that are known as "seal rocks." Such are the famous Seal Rocks off the Cliff House at San Francisco. These are not breeding grounds but resorts of the sea lions and seals, although an occasional pup may be born on them (usually by a cow in her first year of breeding). Hence the observer must be cautious in reporting these resorts, or so-called "hauling grounds," as rookeries.

Among sea lions the same breeding grounds or "rookeries" are used year after year. Just why a certain piece of rocky coast should be selected always when the contiguous pieces are apparently identical is not known, but so it is. The sea lion is polygamous, the breeding bulls forming harems of from ten to twenty or even more.²

² The names applied to the breeding habits and breeding places of the sea lion are most curiously mixed, and these names are used even in scientific literature. The breeding adults are known as bulls and cows; the adults not yet breeding are known as bachelors and virgins; the young of both sexes are called pups; and the breeding places are known as rookeries. Thus the names of the breeding adults are the same as those applied to cattle; the names of adults not yet breeding are those used for humans; the name of the young is the name used for the young of the dog; and the name of the breeding place is the name applied to the breeding places of birds.



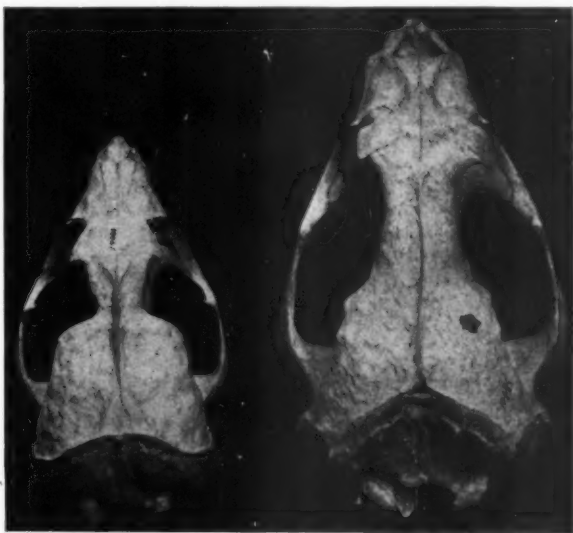
Photographed from specimens in the American Museum

Skulls of male and female of the Steller's sea lion (on the left) and of the California sea lion (on the right) show the comparative sizes of the two species. In the Steller's sea lion the two posterior upper molars are separated by a wide space, whereas those of the California sea lion are close together.

Once I watched the forming of the harems of Steller's sea lion at Año Nuevo Island, a little rocky island lying nearly a mile off shore on the middle California coast. The rookery here is the best situated for observation of any on the coast. The government has a fog signal and light station on the island, and the light keeper's home makes a convenient place to stay when one is fortunate enough to have him for a friend. I was sure of a welcome, for I had passed some time there the year before, during the last of the breeding season. A couple of hundred yards off one end of the island are two smaller islands of bare rock. On one of these is the rookery. One may see nearly the whole of it from the larger island, or one may row over to it and find many convenient hiding places from which to watch the animals at close range. In the latter case it will be necessary for the observer to forget that he has a sense of smell.

I arrived at the rookery on May 29 and found it in possession of a year-old pup, but I was told that a few days before a band of fifteen or twenty cows had "hauled out," to use a sealer's term, for a few hours. The next day small bands of cows landed at different times, but no bulls appeared until evening, when a large one came and started a nucleus of a harem of three or four cows. By morning this had increased to eighteen cows.

Two other bulls had arrived, but their time was so occupied in keeping out of the way of the first bull, who was a big battle-scarred old veteran, and driving away bachelors, who persisted in land-



From specimens in the American Museum

An upper view of the skulls of the female of both species reveals a marked difference in shape of the region between the eyes



From specimens in the American Museum

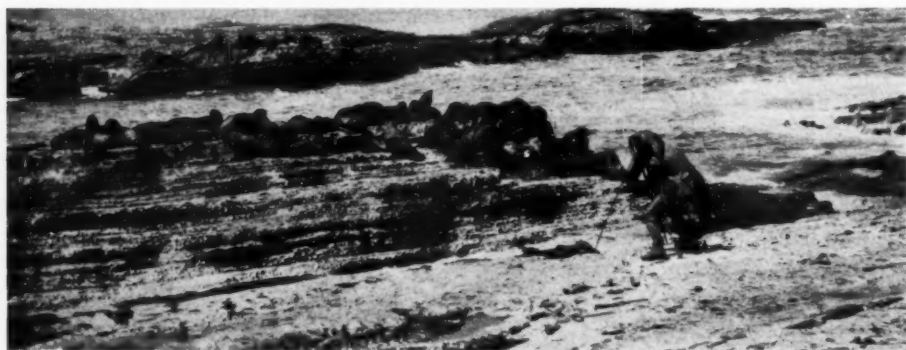
The under side of the same skulls shows clearly the gap between the posterior upper molars of the Steller's sea lion and the regularity of spacing of the corresponding teeth of the California species



Año Nuevo, an island bearing a United States light and fog signal, one mile off the California coast, twenty miles north of Santa Cruz



Steller's sea lions on the bare flat rocks of Año Nuevo. The rookery on Año Nuevo Island is best situated for observation of any on the California coast



At Año Nuevo Island one may reach the flat rocks of the rookery and photograph the young sea lions at his leisure

ing on all sides, that they could do nothing toward forming harems.

The next morning (June 1) our old patriarch had a harem of twenty-three cows, and one of the other bulls had five. Six or eight more bulls arrived during the day, and by night there were two small harems besides the first large one. Our old friend, whom I dubbed Brigham Young, appeared satisfied with the number of his wives and remained quiet all day, except when another bull would come too close. Then he would make a fierce rush to do battle, but the intruder never accepted the challenge. When a cow attempted to land, the other two bulls made such a rush that they succeeded in driving her away more often than "rounding her up" in their harems. The other bulls kept to themselves, occasionally fighting and occasionally retreating before the rushes of some of the three with harems, but not yet attempting to form harems for themselves.

On June 2, the herd had increased to fifty, but by night had decreased to about what it was the day before. The next morning I counted eighty, but by night there were not more than thirty. There were still only three harems divided among our three old friends, who seemed to have an understanding, and no longer trespassed on one another's territory. Three times on two successive days the entire band stampeded into the water for some unknown reason, but soon returned to its original station.

From June 3 to 7 things went on in about the same way, the herds increasing in the morning and decreasing in the afternoon. Hence I decided that the afternoon and night were the hunting and feeding times. Other harems were started, and some of them lost, or fell, to the might of some stronger warrior. The bachelors that had been persistent in landing on the rookery seemed to have lost heart, and formed a little band on the other rocky islet, from which point they answered the roars of the old bulls in a less certain key.

By the middle of the month the cows numbered about one hundred and fifty and were in charge of sixteen or eighteen old bulls. Nearly a hundred pups had been born. The harems were now not at all separated, being in one large herd in which here and there a bull could be distinguished.

Apparently each bull had marked out for himself a certain arbitrary area over which he was lord and master by right of might, and he never left his station except to offer battle to the lord of some adjacent realm.

Soon even this indication of harems was lost, for the bulls did not appear to confine themselves to any one area. No bachelors were allowed to land on the rookery, however. By the twentieth of the month virtually all of the pups had been born, about one hundred and fifty fat, sleek, sleepy little chaps. They were wholly without fear, and one could handle them and walk about among them if he were a little careful to avoid



While the "pups" are young, the "cows" do not always desert on approach. They may prove somewhat aggressive instead

their puppy-like snaps, for their jaws were armed with very sharp little teeth.¹

I have read somewhere that a child with a popgun can drive a whole herd of sea lions into the sea. This is usually so but not always, for they refuse

¹ Each cow bears a single pup each year, the period of gestation being nearly a year. The cow nurses the young nearly to the time the next pup is born. I have been told that when a cow loses her pup for any reason she allows her pup of the year before to keep on nursing. As evidence confirming this I once shot a fat California sea lion pup that was about two months over a year old, and found its stomach filled to its capacity with milk. I have no opinion or evidence as to how long this might continue.

Cows in their first breeding year have their pups earlier than the older ones, often even before the harems are formed. I saw three of these early pups drowned on the Año Nuevo rookery, having been washed from the rocks or clumsily knocked off by their mothers. That the mothers were inexperienced was shown by their futile attempts to save them. I have frequently seen old cows seize their pups by the nape of the neck and dive into the water with them, easily supporting them, and at last bringing them safely out again.



The young sea lions spend much of their time sleeping contentedly on the hard rocks. These pups are probably four or five weeks old

But apparently the cows sometimes have not the skill, or hesitate to do this, for I watched five pups on the main island, that supposedly had been washed off the rookery. Their mothers came every night and at intervals through the day and nursed them. Two of them I saw swim unaided back to the rookery, a couple of hundred yards distant, and against a strong wind and a rather rough sea. They could not have been more than three weeks old, although under other conditions I never saw pups voluntarily enter the sea until they were six weeks or more old.



The Steller's sea lion pup weighs between forty-five and fifty pounds. Its use of the fore and hind flippers in climbing about the rocks is well shown here

to be driven for a short period after the pups are born. At this time they may be dangerous. Although I have never heard of anyone being harmed by a sea lion, boatmen tell many stories of having had to run from a wounded bull or an angry cow. I have had cows make savage lunges at me open-mouthed when I approached too near to a newly born pup, and after receiving such warning I had little inclination to get closer to those big white teeth and bristling whiskers.

Those of us who have children as an excuse for going to the circus, or who are honest enough to admit that we go for our own amusement, remember seeing the trained sea lions catch balls that are thrown to them. This seems to be a natural instinct. Once, when I wished to get a cow out of my way that I might examine a certain pup, I threw a stone at her, and to my surprise she caught it in her mouth. We



Sea lion pups, showing how the body is lifted from the ground and the hind flipper is bent forward in walking

had quite a game of toss and catch until she became enraged and chased me.

I found, during a count of two breeding seasons, that more males were born than females. What becomes of the excess males is difficult to determine. At the rookeries there are two or three times as many females as males. Some of the bulls are perhaps killed in their fights, and one man asserted that most of the breeding bulls die at the end of the breeding season. At any rate, all of the old bulls leave the rookery by the first of July, and it is said none are seen until the next season. The bachelors stay, however, and may be seen on the coast at any time. But even if all of the breeding bulls die, that does not account for the elimination of two thirds of the males.

The cows frequently leave the rookery to get food, but during the three or four weeks of the breeding season the

bulls take no food whatever. In each of fourteen breeding bulls shot at the end of the season the stomach was found empty.

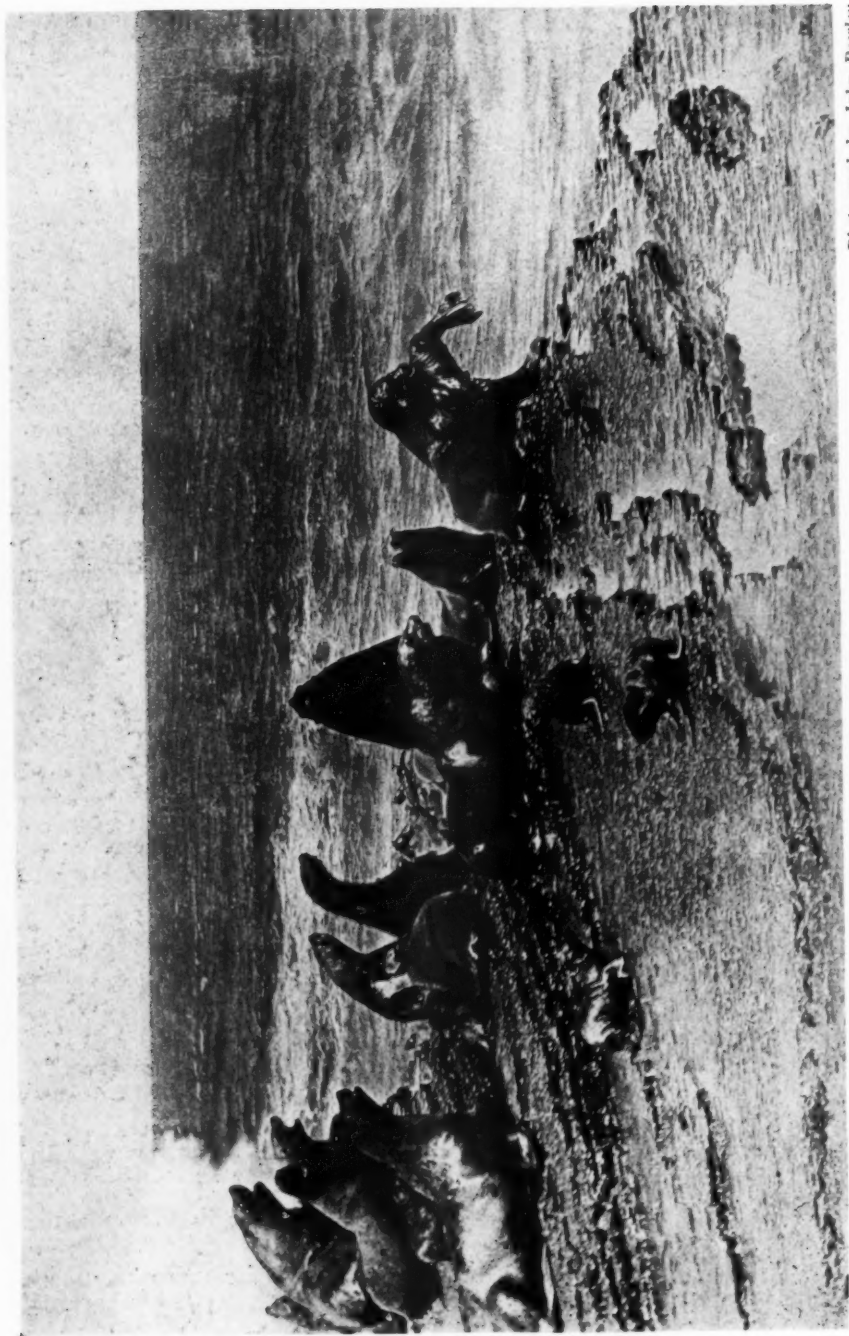
One problem I had in mind was whether a pup would be allowed to nurse from any but its own mother. Often I have seen a pup come nosing up to a cow and be picked up by the neck and thrown ten or twelve feet away, end over end, so that it was a wonder its neck was not broken or its skull fractured. Sometimes the pup would land against or near another cow which would angrily throw it again. Once I saw a pup thus thrown three times before it was allowed to rest. Though the pup may not know its mother, there is no doubt that the mother knows her pup. It was a common sight to see a cow go through a lot of pups, pushing them aside until she found her own, which she would



Some of them look at you, inquiringly; others are too sleepy to note particularly your approach

cuddle beside her with the greatest satisfaction.

Once I marked a pup whose mother had been killed so that I could recognize it at a distance. I watched it for ten days, but after three or four days it began to grow thinner and thinner from day to day. It often tried to



Photograph by John Rowley

ADAPTED FOR LOCOMOTION ON LAND AND IN THE SEA

A Steller's cow with her pup in her mouth about to dive. Detail of the sea lion rookery on Año Nuevo Island



OFF THE ROCKS AT AÑO NUEVO

In California the sea lions resort to rocks which are called "seal rocks." The animals, when approached, make their way rapidly into the water, but having reached a place of safety, they linger and watch the intruder



When annoyed, the young sea lions may growl and snap at your hand, puppy-like, but are quite harmless



A Steller's bull never has been captured alive. The combined efforts of fifteen men, who once lassoed a huge fellow, were insufficient to prevent his escape, lasso and all

nurse but in every case was illtreated, and in the many times I saw it try, I do not believe it ever succeeded in getting the least nourishment. There were always some starving pups on the rookery. One day one of these persisted in sucking the ear of a very fat and sleepy neighbor pup. The sleepy one would shake the other off and growl, but it was so sleepy that it could not keep its eyes open, and the minute it would drop off the other would go at it again. It would be interesting to know whether a cow that had lost her pup would adopt one of these orphans.

Several years ago I helped to examine the stomachs of forty sea lions that were shot for this purpose. The sea lion has always been a bone of contention between people who are interested in preserving them and fishermen, who claim that the animals are depleting the fisheries. Fifteen of the forty were Steller's sea lions, all cows but one young male. Eight of these had fish remains in the stomach, and three of the eight had squid in addition. The stomachs of the remaining seven were empty. In other words, those that had anything in the stomach at all had fish. One of them had nearly thirty pounds of rock cod; one was full of sardines; one had salmon bones.

Twenty-five of the forty were California sea lions, eighteen cows, five young males, and two breeding bulls. Five of these had squid and fish remains in the stomach; eight had squid only; and twelve were empty, two of which were breeding bulls. Among the stomachs that had food remains, two had about two hundred squid pens each, and one had three hundred. The squid pen is a horny rod, shaped like a lance head, that is found along the back of the squid. The squid has a beak much like that of a parrot. In the sea lions' stomachs were a few beaks, but many squid pens. Sometimes many pens

would be present and no beaks at all. The only way we could explain this was that the sea lion had bitten the squid off behind the head. The beaks are of the same substance as the pens, but much harder in composition; so it is scarcely possible that they could have been dissolved by the gastric juices without the pens also dissolving.

Another thing easier to explain was the finding of the "ear bones" of fishes when other bones had disappeared. In this case the digestive juices had dissolved the other bones, but the ear bones, being of harder substance, had remained to the last.

Perhaps the most astonishing things to find in the stomachs were stones. These were sometimes in stomachs otherwise empty; sometimes with much or little food. One stomach had a stone in it as large as a base ball; one had three stones of good size; one had fifteen stones equal to a couple of quarts in bulk; two had four stones of good size in each; one had thirty-one small stones. All of these but the first were of the California sea lion. The economy of this habit never has been explained. Fishermen, looking at it from their standpoint, call the stones ballast.

I do not intend to enter into a discussion of the damage sea lions do to the fisheries. It is certain that some animals do a considerable amount of damage to fishing nets and to netted fish. Some fishermen claim that sharks do more damage than sea lions, others that seals do the most, and still others that all three of these animals—sharks, sea lions, and seals—are equally to blame.

Just why these great animals with such interesting habits have been studied and written of so little is difficult to understand, and one reason for my writing this article is the hope that I may influence someone to study them.



On the Planting of a Class Tree¹

[*Knowledge of the processes of nature leads man to give deeper and wiser thought to human affairs*]

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

I WAS just recovering from my astonishment at being asked to speak on this occasion, and was thinking of the kindness which had given me such an opportunity, and how I might improve the occasion—or at least avoid disgracing it—when I received a “wireless message” from the tree itself. “Now,” said the tree, “I suppose you are thinking that you are of some consequence in this matter, and of the grandiose things you will say; but let me tell you, it is I who am of consequence, I who am to be planted, I who must carry to posterity the message of this class. Long years hence, I must bear witness to successive generations of students and teachers that there once was a class who trusted me, who cared to regard me as a symbol of its hopes and aspirations. For this I must live and grow, and for this I shall modestly esteem myself a little better than the other trees growing hereabouts. But before entering upon this great career, I should like to say a few words, and will ask you to convey them to the class, lest earthly ears be too dull to catch directly the whisperings of my boughs.” Thus spoke the tree: and much abashed, I at once signified my willingness to give up my own proposed speech, and read whatever the tree might dictate. I took down her very words—I say her, for as the Latins well knew, all trees are feminine—and here they are:

The Message of the Tree

Like you, my masters, I once was green. In my freshman days, encouraged by the warmth of the sun, I unfolded my delicate buds and exposed my small green leaves to the light and air. Scarcely, however, had I assumed this verdure when the cold blasts of a storm withered my young foliage. I was chagrined, but with the elasticity of youth I returned to the effort, and tried once more to help fill the landscape with greenness. This time I was more successful, and before long had the pleasure of hearing the passers-by say, “What a nice little tree!” “Isn’t that a jolly little sapling!” or words to similar effect. This made my sap flow fast, and now that the sun was warm and the air balmy, I grew apace. All might have been well, but for a lot of envious, disagreeable bugs and worms, which fell upon me, and devoured my leaves, nay, even burrowed into my stem. These attacks, as summer wore on, made me feel sick and made me look shabby, but I kept on growing, and I realized that I was coming to know intimately the wicked ways of this world. Thus, in the fall, now a senior or a veteran—what you will—I put off all greenness, as inappropriate to my wiser and sadder estate. My leaves, as though in final defiance of all enemies, turned brilliantly red and orange; my wood hard-

¹ Address on the occasion of planting a class tree at the University of Colorado in the spring of 1917.

ened to be ready for all trials and difficulties. Winter found me strong of stem and branch, bare but capable of resisting cold and wind which earlier would have been fatal. I was not so gay, not so tender, as I once had been, but I had suffered and grown stout of heart and strong of body. Well, what now? My masters, let me tell you a secret, it concerns you as well as me. Presently, I shall grow green again! Once again, unwarned by past experience, my tender leaves will spread toward the sky. Again I shall find myself a freshman, timidly setting out on a new journey. Hope and love and joy once more will impel me forward, mindless of the perils on the way. I shall forget, for the time being, that there are storms or worms, forget the cruelty of frost and hail, and the withering summer drought. The old story will be as new as if told for the first time, yet I shall be stronger and better for the experience of past years. Thus I shall win through to the fall and winter, to wait for another spring. So it will be year after year, and as I renew my growth I shall think of you, and wonder whether you have done the same.

For life is rhythmic,—is a process of renewal. The freshman stage is not to be passed and forgotten: we are continually seeking new adventures, exposing our tender hearts and minds to the unknown. Wisdom fosters ignorance, in the sense that it leads

us to new positions, where we are compelled to learn. Hope feeds on the unknown. Love delights in mystery. Some day, when we are old and rigid, the only renewal possible will be through the gates of merciful death; but let us preserve as long as may be the ability to renew our verdure, to wonder and to hope.

Yet as the years pass, the fruits of our labors will accumulate. Nothing need be wasted, and posterity may yet bless us for what we have done. I, your tree, silent after this, shall stand and bear witness, and may I not hope, in the words of a great American poet,¹ that . . . the eyes that look upon me in my later, nobler growth,

"Look also on a nobler age than ours;
An age, when, in the eternal strife between
Evil and Good, the Power of Good shall win
A grander mastery; when kings no more
Shall summon millions from the plough to
learn
The trade of slaughter, and of populous
realms
Make camps of war; when in our younger
land
The hand of ruffian Violence, that now
Is insolently raised to smite, shall fall
Unnerved before the calm rebuke of Law,
And Fraud, his sly confederate, shrink in
shame,
Back to his covert, and forego his prey."

¹ William Cullen Bryant in *Among the Trees*.





CHARLES SPRAGUE SARGENT

Photograph of the bronze bust by C. S. Pietro

This bust has been given permanent place in the forestry hall of the American Museum in honor of Professor Sargent's work in bringing together the Morris K. Jesup collection of North American woods

Museum Notes

SINCE the last issue of the JOURNAL the following persons have become members of the American Museum:

Sustaining Member, PAUL J. BONWIT.

Annual Members, MRS. LESTER M. NEWBURGER, MISSES ELEANOR FERGUSON and M. M. KENNERLY, PROFESSOR EMIL ROLLER, DOCTORS CORNELIUS G. COAKLEY and SCUDDER J. WOOLLEY, MESSRS. A. BALINKY, LOUIS P. BAYARD, THEODORE BERNSTEIN, ROBERT E. BINGER, J. P. BLAIR, IRVING I. BLOOMINGDALE, GUSTAV BLUMENTHAL, H. P. BONTIES, M. J. BREITENBACH, CHAS. BRODMERKEL, JR., WALTER BROWN, OSCAR BURGI, E. R. BURNETT, CHAS. C. CASTLE, FRANK H. CAUTY, FREDERICK H. CLARK, WALLACE FAIRBANK, PERCY S. MALLETT, FRANK SEAMAN and LOUIS WEBB.

Associate Members, MESDAMES CHAS. ULYSSES BEAR and CHAS. LYMAN, MAJOR GENERAL H. L. SCOTT, U. S. A., DOCTORS GLENN F. BOWMAN, DON M. CAMPBELL, J. H. CARSTENS, JOSEPH C. GUERNSEY, ERNEST W. HAASS, EDWARD K. HOPKINS, HOWARD MORROW and GEO. C. PARDEE, MESSRS. C. L. BRUMMÉ, LEO M. BUTZEL, WM. B. CADY, HENRY WALTON CAMPBELL, B. G. CHAPMAN, AUSTIN CHURCH, FREDERICK L. COLBY, JOHN T. COOLIDGE, JR., WINFIELD S. DAVIS, F. T. DUCHARME, ROBERT KUHN, HENRY LEDYARD, ALVAN MACAULEY, EDWARD E. MCNAIR, JOHN BROCKWAY METCALF, J. HENRY MEYER, EDMUND T. PATERSON, JULIUS C. PETER, A. V. PHISTER, GERALD L. RATHBONE, GEORGE B. SPERRY, HOLLINSHEAD N. TAYLOR, SAMUEL HINDS THOMAS, RALSTON WHITE, GEORGE WHITTELL, BALDWIN WOOD and CHAS. M. WOODS.

As an expression of appreciation by the American Museum of the valuable contributions made to the science of silviculture by Professor Charles Sprague Sargent, director of the Arnold Arboretum, Brookline, Massachusetts, a bronze bust, executed by Mr. C. S. Pietro, has been placed in the forestry hall. Professor Sargent received appointment to the position he now holds in 1873. With great scientific ability he combines business faculty and a keen perception of landscape beauty. The work that he has accomplished as head of the Arnold Arboretum is of the highest importance to the science of dendrology, and that institution,

through his efforts, is unique both in the arrangement of its large collection and in the extent and completeness of the experimental work in planting, pruning, and cultivating all varieties of trees and shrubs that will thrive in the climate of New England. He has striven to discover and introduce hardy varieties from all temperate regions of the world. From 1879 to 1884 Professor Sargent made, under government auspices, a survey of the forest areas of the United States, with especial reference to the geographical distribution of various kinds of trees and their commercial value. As a practical continuation of this work, Professor Sargent, through the generosity of Morris K. Jesup, at that time president of the American Museum, made the representative collection of American woods now on exhibition at the Museum. Twenty years of constant work, during which he visited almost every species of tree in its own haunt, were required to accomplish this undertaking. His *Silva of North America*, in fourteen volumes, published as a result of his explorations and his collection of the Jesup woods, is the only work of its kind and is recognized as among the most notable botanical works in America.

At the Fourth National Conference of the American Game Protective Association, held at the Waldorf, New York City, on March 4 and 5, the alarming statement was made that the upland game birds of America, including the bobwhite quail, the grouse, and the woodcock, are nearing extinction. The woodcock, in particular, according to Mr. E. W. Nelson, chief of the United States Bureau of Biological Survey, have greatly diminished in numbers within the last few years. To account in part for this situation a theory was advanced by Mr. John Burnham, president of the association, to the effect that in addition to rigorous winter weather and bad nesting seasons, every ten years there is a cycle of disease which kills off the upland game birds. In a discussion of the present demand, especially in rural districts, that the game laws be suspended for the duration of the war in order that beef and pork may be replaced by game, Dr. William T. Hornaday, director of the New York Zoölogical Park, urged the passage of

bills now before Congress providing for the establishment of game sanctuaries, claiming that by this plan it would be possible to furnish for the nation's consumption not only vast numbers of wild fowl, but also two million deer annually. At the Waldorf meeting the life of migratory birds in Louisiana was shown in motion pictures, and Mr. M. L. Alexander, conservation commissioner, told what that state is doing to preserve the migratory birds within its borders. Other means suggested by different members of the association for the preservation of game in the United States were a shorter open season and smaller bag limits.

ANOTHER mounted figure for the African hall has been completed in the studio of Mr. Carl E. Akeley at the American Museum—the giraffe-like okapi from the Congo region. The same process of mounting has been followed as in the case of the young bull elephant shown in the accompanying illustration, and with the usual lifelike result. The okapi, standing more than five feet to the shoulder, has head uplifted and large ears thrown forward as if alert for the sound which will cause it to plunge into the depths of the underwood—its natural habitat. With its purplish brown body so nearly the color of the tree trunks, and its white legs barred with black, simulating alternate streaks of light and shadow amid the gloom of the forest, this animal may be considered a good example of protective coloration. In structure it resembles the giraffe in having only two toes on each foot, and in the shape of its teeth; it differs in being smaller and shorter of leg and neck, and in having the fore and hind legs about equal in length. The long muzzle is well adapted for feeding on the low forest underwood and swamp vegetation, and the short horns are probably also an adaptation to life in the forest. This animal was first discovered by Sir Henry Johnston in 1901, in the Semliki forest of Uganda, East Africa, and so far as is known, it is confined to that region.

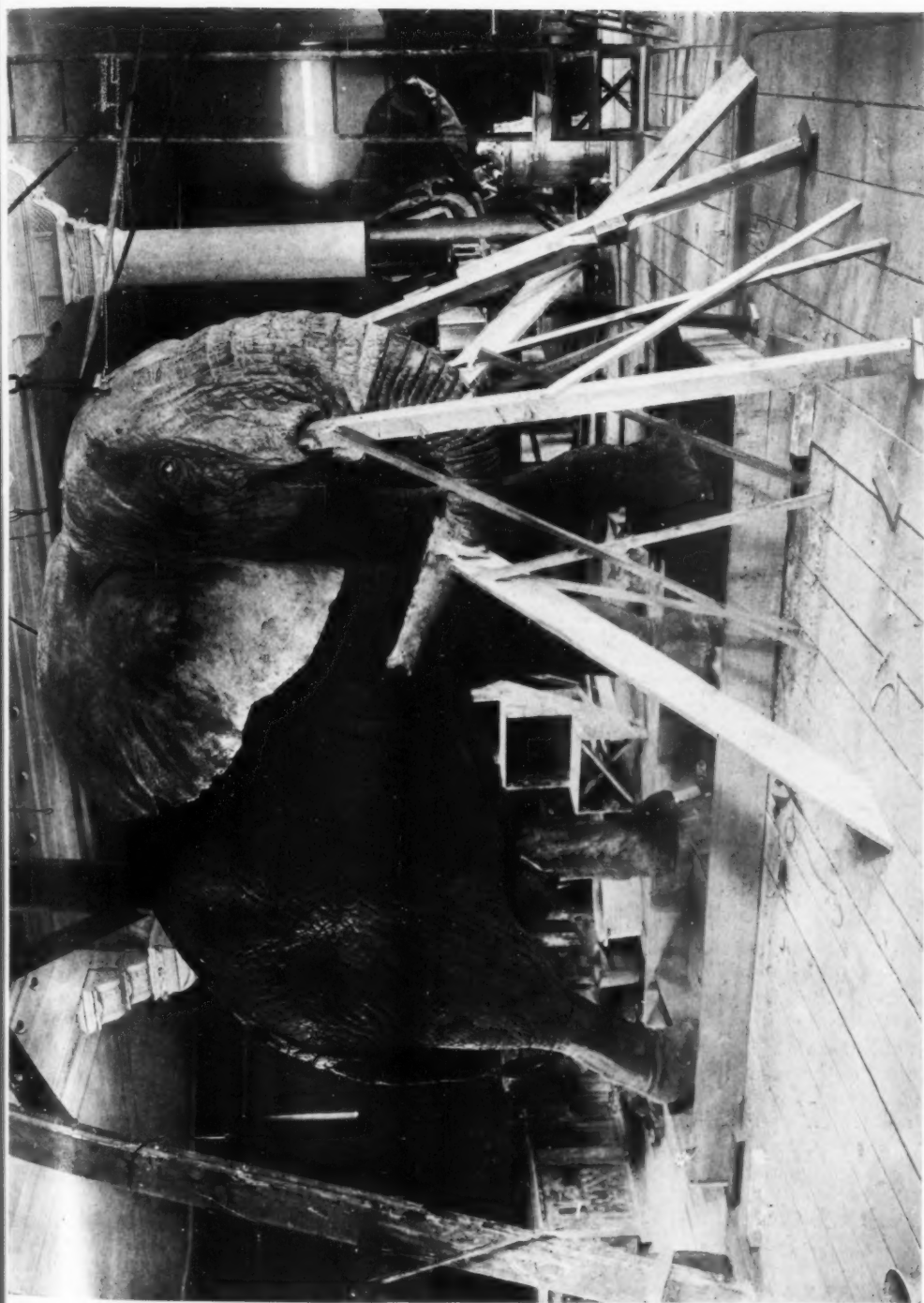
DR. HERMAN K. HAEBERLIN, who was appointed last summer as assistant in the department of anthropology at the American Museum, died in Cambridge, Massachusetts, February 12, 1918. Dr. Haeberlin was a young man of great promise, peculiarly fitted for anthropological investigation, and his death is a decided loss not only to the

Museum but also to anthropology in general.

A SERIES of monthly meetings is being held at the American Museum, under the auspices of the New York Academy of Sciences and the American Ethnological Society, for the purpose of reviewing the results of the Museum's explorations in the Southwest under the grant from Mr. Archer M. Huntington. Dr. Clark Wissler, curator of anthropology, introduced the series in January by a general discussion of "The Cultural Problems of the Southwest." On February 25, Mr. N. C. Nelson dealt with "Southwest Archaeology," with especial reference to the chronology of the Pueblo ruins. The March meeting will be devoted to an illustrated talk by Mr. Earl H. Morris on the progress of the investigations being carried on at the famous Aztec ruin in New Mexico.

MR. EARL H. MORRIS, in charge of the American Museum's explorations at Aztec, New Mexico, arrived in New York about the middle of February. Between June 10 and November 25, 1917, seventy rectangular living rooms and eight circular ceremonial chambers were cleared of debris. This necessitated the removal of more than six thousand wagonloads of earth and stone. The excavated part constitutes the east wing of a quadrangular structure 359 by 280 feet, whose solidly built sandstone walls rise to a height of twenty feet above the surrounding plain. Although the mound of earth resulting from the disintegration of the upper stories of the dwelling had preserved the walls which it covered to a surprising degree, the adobe mortar, wherever moisture had penetrated, had lost its cohesive properties, and, in addition, parts of the walls had been too much weakened by strains developed before the collapse of the structure to permit them to stand long after the removal of the protecting soil. Where such was the case, the walls were torn down and rebuilt in a manner to withstand for many years the action of the elements.

An excellent collection of specimens was obtained during the process of excavation. Burial chambers yielded pottery vessels of varied form and ornamentation, and thousands of beads and articles of personal adornment. From refuse deposits were taken many discarded weapons and implements, besides a surprising representation of textiles, and articles made of hide.



VIEW IN THE ELEPHANT STUDIO OF THE AMERICAN MUSEUM

This young bull elephant is one of a group of four similar animals now being mounted in the studio of Mr. Carl E. Akeley at the American Museum for exhibition in the proposed African hall. These huge beasts are of proportions so vast that they dominate the whole visible space of the eighty-foot studio. The success of the method of taxidermy originated and perfected by Mr. Akeley is demonstrated in such pieces of work as this and the okapi recently completed



Steller's sea lion (*Eumetopias stelleri*), subject of the above group in the new Museum of the California Academy of Sciences, San Francisco, ranges from Año Nuevo Island, near Santa Cruz (on which this rookery is located), northward to Bering Strait. The large male in the center of the group weighed 1810 pounds. Although most fishermen believe sea lions to be very destructive to commercial fisheries, investigations have proved the contrary, and they should be protected at least to some extent. A second species, the California sea lion (*Zalophus californianus*), is common from San Francisco southward. It is an intelligent animal and is frequently seen in captivity in zoological parks

Although the position of the Aztec ruin in the chronological sequence of the Southwest marks it as relatively ancient, its excellent masonry and the manufactured articles collected in last year's work show that its inhabitants had developed a wealth of material culture which the Pueblos never surpassed in later times.

In its new museum in Golden Gate Park, San Francisco, the California Academy of Sciences has recently installed a number of habitat groups illustrating the most interesting species of California mammals and birds in their natural environment. Both the taxidermist and the artist visited the various regions where the animals were obtained, in order to make the settings,

whether painted or natural, as realistic as possible. The case for each group is twenty-five feet long, thirteen feet deep, and eighteen feet high, with a forty-foot curving background. As there are no windows in the exhibition halls, the lighting being from above, reflections in the front glass of the groups are almost entirely avoided. The northern mule deer and black-tailed deer, found in the coast mountains of California, form the subjects of two groups showing the beautiful scenery of that region, while the elk and antelope, of northeastern California, are no less charmingly presented. In contrast with these is the desert-like region in southern California, in the vicinity of San Jacinto Peak, where mountain sheep are fairly common. The barrel cactus, which



furnishes for these animals both food and drink, appears in the group. Another group shows the northwestern black bear, with its young, in a den among the rocks. This bear, in California as elsewhere, may be either black, brown, or even cinnamon, young of two colors sometimes appearing in the same litter. A second rocky den is occupied by a family of mountain lions, largest of North American cats and destructive to deer, being said to destroy annually an average of one deer a week. Moraga Valley, with Mt. Diablo for a background, is a picturesque setting for the coyotes. Four species of this animal are recognized in California. In the colder parts of its range it acquires a good coat of fur which has a fair commercial value. Raccoons and skunks, both well-known fur bearers, are seen in another group, while seals and sea lions are picturesquely represented in three different regions south of San Francisco. Water birds in the San Joaquin Valley, sea birds on the Farallon

Islands, and a desert bird group, depicting a bit of the Colorado desert near the Salton Sea, represent three phases of bird life. The groups have been installed under the general direction of Dr. Barton Warren Evermann, the director of the museum. The mammal groups were prepared under the immediate supervision of Mr. John Rowley, assisted by Mr. Joseph P. Herring, while the bird groups were prepared by Mr. Paul J. Fair. Most of the backgrounds were painted by Charles A. Corwin and Charles B. Hudson.

A DINNER in honor of Mr. F. W. Hodge, until lately Chief of the Bureau of Ethnology, Washington, D. C., but now connected with the Museum of the American Indian in New York City, was given at the Faculty Club of Columbia University on the evening of March 9 by local anthropologists. The guests numbered about thirty. After-dinner speeches, voicing the gratification of the many friends of Mr. Hodge in New York that his work now lies in this city, were made by Professor Franz Boas of Columbia University, Dr. Clark Wissler and Dr. P. E. Goddard of the American Museum, and Mr. George H. Pepper of the Museum of the American Indian. Mr. Hodge responded in appreciative terms. That hearty coöperation should exist among all scientific institutions was the prevailing sentiment.

ARCTIC fishes are so few in number that almost all of them are known to science. Yet rarely are any brought back in a sufficiently good state of preservation to be studied to advantage. A small collection obtained by the Crocker Land Expedition is therefore of considerable interest. The trout, or more properly speaking, charrs, from this collection (the only fish which were found in fresh water) are now being examined by Dr. William C. Kendall of the United States Bureau of Fisheries, who has for many years made a special study of the species and distribution of trout. The marine fishes with the exception of the interesting smeltlike capelin are mostly allied to the cods and the sculpins, in fact, are almost identical with cold-water species of these groups which abound off rocky New England coasts. A particularly fine series of Greenland sculpins,—large-mouthed, thorny-headed fishes whose mottled colors blend with the bottom on which they lie, will furnish exhibition material to illustrate sexual dimorphism. The males have more contrasted colors and the first or spiny back

fin, comparatively high and broad. Stomach examination shows that the Greenland sculpin had been feeding on small crustaceans (resembling our shrimp and sand hoppers) which abound in polar seas. They doubtless will eat almost any creature that comes within reach of their cavernous maws.

DR. C-E. A. WINSLOW, curator of the department of public health at the American Museum, is serving as a member of two of the subcommittees of the Medical Advisory Board of the Council of National Defense, in connection with nursing and child hygiene, respectively.

THE department of invertebrate zoölogy of the American Museum has just received from Mr. Charles W. Leng an important accession of Coleoptera, adding more than seven hundred species to the Museum's collection.

DURING January a new window group was put on exhibition in the Darwin hall of the American Museum, illustrating the animals and plants of a tide pool on our northern New England coast, based on studies made by the department of invertebrate zoölogy at Nahant, Massachusetts, during recent years. It is the work of Messrs. Show Shimotori, Chris E. Olsen, Herman Mueller, and the late Ignaz Matusch, under the direction of Mr. Roy W. Miner. A more detailed description of this group with illustrations will appear in an early number of the JOURNAL.

MISS MARY ELIZA AUDUBON, granddaughter of the famous naturalist, died on November 23, 1917, at the home of her sister in New Haven, Connecticut. Miss Audubon was born in New York City, at Audubon Park on the banks of the Hudson, then her grandfather's estate. She was a woman of dignity, sweetness, and unselfishness. The large painting entitled "Pheasants," the work of Audubon, had been recently presented to the American Museum by Miss Audubon, who was connected with the institution for many years as life member.

WHEN the building which stood at Broadway and Quincy Street, Cambridge, Massachusetts, burned early in 1917, a notable

landmark was thereby destroyed, one which might well have been preserved for all time as a monument to one of America's famous men. For this house had been for many years the home of Professor Louis Agassiz, and after him of his son Alexander for a longer period. Designed especially for Professor Agassiz, it was occupied by him from 1854 to 1873 and during that time was the scene of many interesting events. It was here between 1855 and 1863 that hundreds of young women received instruction from the great naturalist, who was assisted in his work by his wife and daughter. The house was known as one of the most hospitable homes in Cambridge and Boston. Distinguished men of science were entertained within its walls, and many a Harvard man who was young at that time remembers with pleasure its hospitalities. The land upon which the house stood was bequeathed by Alexander Agassiz to Harvard College. It is hoped that when the war activities which now engross the attention of the entire university are no longer necessary plans may be developed for marking the site of the Agassiz House.

ON the evening of February 28, 1918, the American Museum, in coöperation with delegates from the New York Academy of Sciences, the American Association for the Advancement of Science, the New York Mineralogical Club, and other institutions, celebrated the 175th anniversary of the birth of Abbé René Just Haüy (1743-1822), the founder of crystallography. There were read papers by George F. Kunz, Herbert P. Whitlock, Edgar T. Wherry, Frank D. Adams, Henry S. Washington, Alexander Vachon, Edward H. Kraus, and Alexander Hamilton Phillips, and one written for the celebration by the late L. P. Gratacap was also presented. An exhibition of books, portraits, and other memorabilia was arranged in special cases in the mineralogical hall of the Museum and included one original letter and two photostats of the only four letters still in existence which were written by Abbé Haüy.

With a knowledge of crystallography it frequently requires but a glance to determine a mineral either by its crystalline form or by its cleavage—or perhaps the measurement of a few faces by a hand goniometer—obtaining a result that can be verified chemically in a few minutes; whereas an analysis

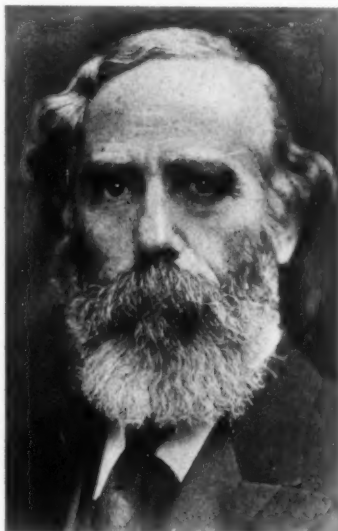
would require hours or days. To Abbé René Just Haüy we are indebted for the discovery upon which the science of crystallography is based. One day he accidentally dropped a hexagonal crystal of calcite (carbonate of lime) and his keen observation noted in a moment that when the crystal broke it parted or cleaved into rhombohedrons, and that these would break into rhombohedrons *ad infinitum*. He ascertained that these cleavage forms were always the same in the same mineral; and from the fact that certain substances have a constancy of crystalline structure the world over, more especially in the cleavage, he established the principle that the identity of a mineral always could be determined by its crystalline form. Thus calcite is always rhombohedral; the diamond is octahedral; and others in like manner. Furthermore, when certain minerals crystallize in the same system, some slight peculiarity on the surfaces or striations on the side will aid in identifying just what the mineral is. The study of crystallography, therefore, was never more important than at the present time, when, because of the constant search for war minerals, it is most important that determination of these minerals be made rapidly.

MR. B. T. B. HYDE has presented to the library of the American Museum a large number of the original plates of J. O. Westwood's *Arcana Entomologica; or illustrations of new, rare, and interesting Insects*, published in London in [1841]-1845, in two volumes.

THE large Florida reptile group, in a darkened gallery on the second floor of the American Museum, constructed under the direction of Miss M. C. Dickerson, is completed, and will be open to the public by the end of March. Among those who have worked on the group are Mr. Frederic H. Stoll, colorist and wax modeler, Mr. Hobart

Nichols, landscape artist, and the late Mr. Ernest W. Smith, taxidermist.

THE death, at the close of 1917, of Dr. Henry M. Leipziger, supervisor of the Board of Public Lectures of New York City, was an event of large importance inasmuch as it deprived this city of a man whose concern for the education of the masses has been one of the great uplifting influences in the community. Dr. Leipziger was a native of Manchester, England. He came to America



The late Dr. Henry M. Leipziger, supervisor of the Board of Public Lectures, New York City

in his youth and obtained his education in the public schools and colleges of New York City, in which he afterward gave instruction for eight years. Ill health compelled him to give up this work, whereupon he traveled and studied in Europe for three years. When he returned to New York, in 1883, the city was endeavoring to deal with the problem of adjusting itself to the needs of a large influx of Jewish immigrants, and he was asked to take charge of a trade school for boys. Later, he organized the Hebrew Technical Institute. Dr. Leipziger combined the qualities of the student and thinker with wide human sympathies.

It became the dream of his life to bring the privileges of higher education within reach of all the people. To this end he devised and introduced into the schools the public lecture system, which from a small beginning has developed into a number of elaborate courses, each comprising a series of lectures upon topics of general interest in science, literature, music, and art. The American Museum has been one of the centers for these lectures for many years. It is hoped that this great work for the people, to which he devoted his entire energies for more than twenty years, will not be allowed to disappear from the public educational system of New York.

A BULLETIN entitled "A War Time Diet," issued in February by the department of

public health of the American Museum, provides a marketing list designed to show what food an average family of two adults and three children should buy weekly on an income of fifteen hundred dollars a year. The list sets forth the various proportions of starch, sugar, fat, protein, fruits, vegetables, and milk which should be consumed during the week to insure a well-balanced and healthful diet and at the same time provide for the economies urged by the United States Food Administration. The public is asked to check up weekly purchases and see if food has been bought intelligently. All possible readjustments in our former mode of living should be made to meet the special needs of our army in France and of our Allies.

A particularly large and handsome specimen of copper ore from Arizona and an unusual specimen of lemonite and manganese oxide showing a mosslike development, in which are crystals of native copper bearing tufts of malachite, have been presented to the American Museum by Dr. L. D. Ricketts.

AN accession of considerable importance to the work in herpetology at the American Museum was recently obtained through an exchange with the Commercial Museum of Philadelphia. While there are many exotic species in this collection, especial interest attaches to the specimens from Costa Rica and Colombia, which include the types of twenty-five species described by Cope. The bulk of this material was collected by Mr. George K. Cherrie for the Museo Nacional of Costa Rica. In return for these specimens an exhibit of cotton plants, prepared in the taxidermy shops of the American Museum, will be sent to the Commercial Museum.

THE Fifth Annual Report of the Pension Board of the American Museum, for the year 1917, shows the increase of membership in this Fund during the year to be thirty-six, with losses due to resignations, dismissals, retirements, and deaths to the number of twenty-one, making the present total 256. Through the good offices of friends of the institution, the Board has been enabled to provide various forms of relief in the way of employment or medical attention to the

members of families of deceased subscribers. In addition, endowed beds in the Mt. Sinai and Presbyterian hospitals have been placed at the disposal of the secretary, Mr. George N. Pindar, where free attendance will be given to employees who may need hospital treatment. Through a plan formulated by the officers of the Board, and by the generosity of certain trustees who advanced the necessary funds, opportunity to subscribe to the Liberty Loans on easy payments was given to the members. Many officers and members of the Fund, which amounted to \$22,250, are now in war service. Dr. George M. Mackenzie, medical examiner for the Board, is at the Brooklyn Navy Yard serving as medical examiner for the Naval Reserve Force. Mr. S. Herbert Wolfe, consulting actuary, after being detailed to Washington where he assisted in drafting the present measure for soldiers' insurance and compensation in the United States, was sent to France. Of the members, some have entered the Federal Service from the National Guard, some have enrolled in various branches of the Army, and others have entered the Navy.

ACCORDING to Chancellor Jordan of Stanford University, a new food fish, which may prove of considerable economic importance, has appeared in the California market. This is the priest fish (*Erilepis*), which reaches a weight of two hundred pounds and is found also in Japan. Dr. Jordan says: "It will probably be found in abundance on rocky shallows in the North Pacific; if so, it will prove one of our best food fishes, ranking with the halibut. The flavor is rich and delicate, a little fat, but the oil without the strong flavor seen in mackerels and sardines. It is in fact very much like that of *Anoplopoma*, which is now being largely pushed under the name of 'sablefish' and is, by the way, both fresh and smoked a real addition to our food supplies. The fishermen call the priest fish 'deep-water cod.'" The priest fish has not the least right to be called cod, nor indeed have several other excellent food fishes which bear the name, for instance, the Alaska black cod, another name for the sablefish, and the cultus cod, an excellent and important food fish of our Pacific coast which reaches a weight of from thirty to forty pounds. All three of these fishes are related to one another and remotely related to the sculpins, a very uncodlike group.